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THE ANATOMY OF THE HUMAN BONES and NERVES.

WITH

An Account of the Reciprocal Motions of the HEART,

AND

A Deſcription of the HUMAN LACTEAL SAC and DUCT.

Corrected and enlarged in the SIXTH EDITION,

By ALEXANDER MONRO, *Senior*, M. D. and F. R. S. *Fellow of the Royal College of Phyſicians, and Profeſſor of Medicine and of Anatomy in the Univerſity of* Edinburgh.

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TO THE
STUDENTS of ANATOMY
IN THE
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GENTLEMEN,

WHEN *this* Oſteology *was firſt printed in* 1726, *I did not know that* Albinus, Winſlow, *and* Palfyn, *were to publiſh Deſcriptions of the Bones; otherwiſe my Papers probably would have remained yet undelivered to the Printers. I however flatter myſelf, that this* Eſſay *has been of Uſe to the Gentlemen who did me the Honour to attend my Lectures, by aſſiſting them to underſtand my Senſe and Repreſentation of Things in this fundamental Part of Anatomy; and that it has poſſibly been of more Advantage to them than a more compleat Work from an abler Hand, unleſs my Demonſtrations had been in the Order and Method of ſuch an Author.*

This View of your Improvement, Gentlemen, is a prevailing Argument with me, to cauſe this Eſſay to be reprinted; and you cannot reaſonably blame me, if I likewiſe acknowledge another Motive for it, which more particularly relates to myſelf. In a new Edition an Author has an Opportunity of making his Works more correct, compleat, and conſequently acceptable to the Public, who may perhaps be indulgent enough to think this little Treatiſe not altogether uſeleſs; ſince more Reaſoning on the Structure and morbid Phænomena of Bones is to be found in it, than in the other Writers, who have confined themſelves almoſt entirely to the deſcriptive or proper anatomical Part of the Oſteology.

I have here kept to the Plan of the former Editions, by firſt conſidering, in the Order that ſeemed to me moſt natural and methodical, every thing which I thought neceſſary to be known concerning Bones in general; and, in the ſecond Part, I have deſcribed the ſeveral Bones compoſing the Skeleton.

The Bones of Adults are what I principally endeavour to deſcribe; but I have added

added as much of the Oſteogenea, *as I think ſerviceable in the Practice of Phyſic and Surgery.*

That little might be omitted of what was formerly done on this Subject, I have taken all the Aſſiſtance I could from Books; but have never aſſerted any anatomical Fact on their Authority, without conſulting the Life, from which all the Deſcriptions are made; and therefore the Quotations from ſuch Books, ſerve only to do Juſtice to the Authors, who have remarked any Thing in the Structure of the Parts that was commonly omitted, and to initiate you in the Hiſtory of Anatomy; which I once propoſed to make complete, ſo far as related to this Subject; but not being able to procure ſeveral Books, and being ſenſible how many more may have never come to my Knowledge, I laid aſide this Deſign, of Purpoſe omitted many I could have inſerted, and in ſome Places I have changed an older Author for a later one, who has more fully or clearly deſcribed what I treated of. Beſide Anatomiſts, I have alſo named ſeveral other Authors to confirm my Reaſoning by practical Caſes; of which it is not to be ſup-

poſed my own Experience could furniſh a ſufficient Variety.

You'll readily obſerve, that I quote no Paſſages with a View to criticiſe or condemn them. This Precaution of giving no Offence, is very neceſſary in thoſe who are ſufficiently conſcious of their being liable to lay themſelves open to juſt Cenſure; and it prevents Occaſions of uſeleſs Wrangling, in which generally both Parties are Loſers, and the Public has little Advantage.

In this Treatiſe I always make uſe of the moſt common Name of each Part, and have put the ſynonymous Names to be met with in Books at the Foot of the Page, that the Reading might be ſmoother, and you might conſult them at your Leiſure to aſſiſt you in underſtanding different Authors.

The Deſcriptions and Reaſoning are here blended, without which I always find young Anatomiſts are ſoon diſguſted with Authors: Their Imaginations cannot follow a long Chain of Deſcriptions, eſpecially when they are not taught at the ſame time the Uſes which the deſcribed Parts ſerve: Their Minds muſt have ſome Relaxation, by a Mixture of Reaſoning, which *never miſſes to ſtrike the Fancy agreeably, and raiſes a ſtrong Deſire to underſtand the Principles on which it depends.*

The Phænomena *of Diſeaſes are all deduced in this Eſſay, from the Structure of the Parts, by way of Corollaries and Queſtions; which ſuch an anatomical Work confined me to. And this Method has otherwiſe a good Effect: For, when one meets with an uſeful Propoſition, and is obliged to employ a little Thought to find out its Solution, the Impreſſion it makes is deeper, and he acquires a Fondneſs for it, as being in Part his own Diſcovery. My Pupils have frequently aſſured me, that they could, with very ſmall Reflexion, trace out the whole Reaſoning from which my Concluſions were drawn; I hope their Succeſſors will alſo think this an agreeable Manner of being inſtructed.*

Thoſe Gentlemen who deſired I would add the Lectures which I pronounce in my Colleges as a Commentary upon the Text, where the Diſeaſes are mentioned, will, I perſuade myſelf, excuſe me for not complying with their Deſire, when they conſider the Deſign of this is to be a School-book, and how great the

THE

ANATOMY

OF THE

HUMAN BONES.

PART I.

Of the Bones in general.

BONES are covered by a Membrane, named on that account PERIOSTEUM*, which is ſo neceſſary to them, that we muſt examine its Texture and Uſes, before we can underſtand their Structure.

The *Perioſteum*, as well as moſt other Membranes, can be divided into *Layers* of Fibres. The *exterior* ones, compoſed of the Fibres of the Muſcles connected to the Bones, vary in their Number, Size and Direction, and conſequently occaſion a very great Difference in the Thickneſs and Strength of the *Perioſteum* of different Bones, and even of the different Parts of the ſame Bone.——The *internal* Layer is every where

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* *Membrana circumoſſalis, omentum oſſibus impoſitum.*

where nearly of a ſimilar Structure, and has its Fibres in the ſame Direction with thoſe of the Bone to which they are contiguous. Ought not then the name *Perioſteum* to be applied, ſtrictly ſpeaking, only to this internal Layer, to which the others are joined in an uncertain Manner and Number?

Some authors *(a)* endeavour to prove the internal Layer of Fibres of the *Perioſteum* to be derived from the *Dura Mater:* For, ſay they, ſince the Membrane covering the Scull is plainly a Production or Continuation of the *Dura Mater*, which paſſes out between the Sutures; and ſince there are Muſcles on the Head, as well as in other Parts, which might furniſh a *Perioſteum*, it is needleſs to aſſign different Origins to Membranes which have the ſame Texture and Uſes. They add further, in proof of this Doctrine, that the *Perioſteum* extends itſelf along the Ligaments of the Articulations from one Bone to another; and therefore is continued from its Origin over all the Bones of the Body.—While Anatomiſts were fond of the Hypotheſis of all Membranes being derived from one or other of the two that cover the Brain, a Diſpute of this kind might be thought of Conſequence: But now that the Hypotheſis is neglected as uſeleſs, it is needleſs to examine the Arguments for or againſt it.

Except where Muſcles are inſerted into the *Perioſteum*, its external Surface is connected to the ſurrounding Parts by thin cellular Membranes, which can eaſily be ſtretched conſiderably, but ſhorten themſelves whenever the ſtretching Force is removed. When theſe Membranes

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(a) Havers, Oſteolog. nov. Diſc. 1. p. 16.

branes are cut off or broken, they collapſe into ſuch a ſmall Space, that the Surface of the *Perioſteum* ſeems ſmooth and equal.

When we attempt to tear off the *Perioſteum* from Bones, we ſee a great Number of white Threads produced from the Membrane into them; and, after a ſucceſsful Injection of the Arteries with a red Liquor, numerous Veſſels are not only ſeen on the *Perioſteum (a)*, but moſt of the Fibres ſent from the Membrane to the Bone, ſhew themſelves to be Veſſels entering it, with the injected Liquor in them; and when they are broken, by tearing off the *Perioſteum*, the Surface of the Bone is almoſt covered with red Points.

The Veins correſponding to theſe Arteries are ſometimes to be ſeen in Subjects that die with their Veſſels full of Blood; though ſuch numerous Ramifications of them cannot be demonſtrated as of the Arteries, becauſe few of them have naturally coloured Liquors in them, and ſuch Liquors can difficultly be injected into them.

The great Senſibility of the *Perioſteum* in the deep-ſeated Species of *Paronychia*, in *Exoſtoſes*, *Nodi*, *Tophi*, and *Gummata*, from a *Lues venerea*, or whenever this Membrane is in an inflamed State, is a ſufficient Proof that it is well provided with Nerves, though they are too ſmall to be traced upon it; and therefore one cannot well determine, whether they are ſent along with the Arteries in the common Way, or are

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(a) *Ruyſch.* Epiſt. 5. Tab. 5. Fig. 1. 2. Epiſt. 8. Tab. 9. Fig. 1, 9.

derived from the tendinous Fibres of the Muſcles expanded on the *Perioſteum* (a).

Veſſels alſo paſs through the *Perioſteum* to the Marrow; of which more hereafter. And frequently Muſcles pierce through the *Perioſteum*, to be inſerted into the Bones.

The chief Uſes of the *Perioſteum* are: 1. To allow the Muſcles, when they contract or are ſtretched, to move and ſlide eaſily upon the Bones; the ſmooth Surface of this Membrane preventing any ill Effects of their Friction upon each other. 2. To keep in due Order, and to ſupport the Veſſels in their Paſſage to the Bones. 3. By being firmly braced on the Bones, to aſſiſt in ſetting Limits to their Increaſe, and to check their Overgrowth. 4. To ſtrengthen the Conjunction of the Bones with their *Epiphyſes*, Ligaments and Cartilages, which are eaſily ſeparated in young Creatures, when this Membrane is taken away. 5. To afford convenient Origin and Inſertion to ſeveral Muſcles which are fixed to this Membrane. And, laſtly, to warn us when any Injury is offered to the Parts it covers; which, being inſenſible, might otherwiſe be deſtroyed without our Knowledge, or endeavouring to procure a Remedy.

When the cellular Subſtance connecting the *Perioſteum* to the ſurrounding Parts is deſtroyed, theſe Parts are fixed to that Membrane, and loſe the ſliding Motion they had upon it; as we ſee daily in Iſſues, or any other tedious Suppurations near a Bone.—When the Veſſels which go from the *Perioſteum* to the Bones, are broken or eroded, a Collection of Liquor is made between them, which produces a ſordid Ulcer or rotten Bone. This often is the Caſe after Fractures of Bones, and Inflammations of the *Perioſteum*, or after *Small-pox*, *Meaſles*, *Spotted Fevers*, and *Eryſipelas*.—Do not the Diſorders of the *Perioſteum*, coming along with or ſoon after the cutaneous Diſeaſes, indicate a Similarity of Structure in the *Perioſteum* and Skin?

(a) See the Diſpute about the Senſibility of this and of other Membranes in *Zimmerman*, Diſſert. de Irritabilit.—— Act. Gotting. Vol. 2. *Haller*. Sur la nature ſenſible et irritable.—*Whytt's* phyſiolog. Eſſays II.—*Reimar*. Diſſert. de Fungo Articulor. § 26. 34.

The BONES are the moſt hard and ſolid Parts of the Body, and, as all other Parts where large Veſſels do not enter, are generally of a white Colour; only in a living Creature they are bluiſh, which is owing to the Blood in the ſmall Veſſels under their Surface. The leſs therefore and fewer the Veſſels are, and the thicker and firmer the bony Surface covering the Veſſels is, the Bones are whiter. Hence the Bones of Adults are whiter than thoſe of Children; and, in both young and old, the white Colour of different Bones, or of the ſeveral Parts of the ſame Bone, is always in Proportion to their Veſſels and Solidities; which Circumſtances ought to be regarded by Surgeons, when they are to judge of the Condition of Bones laid bare.

Bones are compoſed of a great many *Plates* *, each of which is made up of Fibres or Strings united by ſmaller Fibrils *(a)*; which being irregularly diſpoſed, and interwoven with the other larger Fibres, make a reticular Work.—

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* Squamæ, Bracteæ, Laminæ.

(a) Malpigh. Anat. Plant. & oper. poſthum.

This Texture is plainly ſeen in the Bones of Fœtuſes, which have not their Parts cloſely compacted, and in the Bones of Adults which have been burnt, long expoſed to the Weather, or whoſe Compoſition has been made looſe by Diſeaſes.—The Chinks which are generally made according to the Direction of the larger Fibres of Bones that have undergone the Action of Fire, or of the Weather, ſhew the greater Strength of theſe than of the Fibres which connect them.—Numerous accurate Obſervations of the different Times in which Exfoliations are made from the Sides or Ends of ſimilar Bones, might bid fair to determine what is the proportional Force of Coheſion in the two ſorts of Fibres.

The Plates are ſaid *(a)* to be firmly joined to each other by a great Number of *Claviculi*, or ſmall bony Proceſſes, which, riſing from the inner Plates, pierce through ſome, and are fixed into the more external ones. Of theſe Nails, four Kinds, *viz. the perpendicular*, *oblique*, *headed*, and *crooked*, have been deſcribed: But in Bones fitly prepared, I could only ſee numerous irregular Proceſſes riſing out from the Plates *(b)*.

Though the exterior Part of Bones is compoſed of firm compact Plates, yet they are all more or leſs cavernous internally. In ſome (*e.g.* middle thin Part of the *Scapula* and *Os Ilium*) the ſolid Sides are brought ſo near, that little Cavity can be ſeen; and in others (middle of *Os Humeri*, *Femoris*, &c.) the Cavities are ſo large, that ſuch Bones are generally eſteemed

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(a) Gagliard. Anat. oſſium nov. invent. illuſtrat. cap. 1. Obſ. 2.

(b) Malpigh. oper. poſthum.

to be hollow or fiſtular. But the internal ſpongy Texture is evident in young Animals; and ſome of it may be ſeen to remain in thoſe of greateſt Age, when Bones are cautiouſly opened, after they have been kept ſo long as to be free of the Oil they contain, or after being burnt.

This ſpongy cavernous internal Part of Bones, is generally called their *Cancelli*, or LATTICE-WORK, and is formed in the following Manner. The Plates are firmly joined about the Middle of the Bone; but as they are extended towards its ends, the more internal Plates ſeparate from the exterior, and ſtretch out their Fibres towards the Axis of the Bone, where they are interwoven with the Fibres of other Plates that have been ſent off in the ſame Way. Seeing the Plates are thus conſtantly going off, the ſolid Sides of the Bones muſt become thinner, and the Lattice-work muſt be thicker and ſtronger, towards their Ends. This is evident in many of them, where the ſolid Sides of their Middle are very thick, and the *Cancelli* are ſcarce obſervable; whereas, at the Ends, where their Diameter is greateſt, the ſolid Walls or Sides are not thicker than Paper, and the *Cancelli* are numerous and large enough to fill up the whole Space left between the Sides.

The Twiſting and Windings which theſe *Cancelli* make, and the Interſtices which they leave, differ conſiderably in Figure, Number and Size, and therefore form little Cells, which are as different, but communicate with each other. Some Writers *(a)* minutely remark theſe different

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(a) Gagliard. Anat. oſſium, cap. 1. Obſ. 4. 5. 6. 7.

ferent Appearances of the *Cancelli*, after they begin to ſeparate from the Plates; and from thence diſtinguiſh them into *wrinkled*, *perforated*, and *Net-like*.

The *Cancelli* ſuſtain the membranous Bags of the Marrow which are ſtretched upon them, and thereby hinder theſe membranous Parts to be torn or removed out of their proper Places, in the violent Motions and different Poſtures which the Bones are employed in. This Support which the *Cancelli* afford the Marrow, alſo ſaves its Membranes and Veſſels, in the lower parts of the Bones, from being compreſſed by the Weight of the Marrow above.

The Depreſſions between the Fibres of the external Plates of Bones appear like ſo many Furrows on their Surface, into each of which the *Perioſteum* enters; by which the Surface of Contact, conſequently the Coheſion, between it and the Bone, is conſiderably increaſed, and a greater Number of Veſſels is ſent from it into the Bone, than if it was a plain Surface.

Both on the Ridges and Furrows, numerous little Pits or Orifices of Canals are to be ſeen, by which the Veſſels paſs to and from the Bones.

After a ſucceſsful Injection, the Arteries can be traced in their Courſe, from the Pits to the Plates and Fibres; and, in ſawing, cutting or raſping the Bones of living Creatures, theſe Veſſels diſcover themſelves, by the ſmall Drops of Blood which then ouze out from the moſt ſolid Part of the Bones. But the cleareſt Demonſtration of the intimate Diſtribution of theſe ſmall Arteries, is, to obſerve the Effect of ſuch a tinging Subſtance as can retain its Colour, when ſwallowed, digeſted and mixed with the Blood of any living Animal, and at the ſame time has Particles ſmall enough to be conveyed into the Veſſels of the Bones; ſuch is *Rubia tinctorum*, Madder-root *(a)*: For we ſee the gradual Advances which this Tincture makes from the *Perioſteum* into the more internal Parts of the Bones, and how univerſally the Diſtribution of the Liquors is made, the whole bony Subſtance being tinged. Whether the Time in which this tinging Liquor paſſes from the outer to the internal Plates, till all the Plates are made of its Colour, and the Time which the diſappearing of the Dye, after giving the Creature no more of this ſort of Food, makes us think it takes to return, are the ſame in which the natural Liquors circulate, is uncertain; becauſe this tinging Subſtance may move more ſlowly, or may paſs more quickly, than the natural Liquors do. —The Arteries are larger near each End than at the Middle of the large Bones that are much moved; becauſe they not only ſerve the bony Plates near the Ends, but paſs through them to the Marrow.—As Animals advance in Age, the Arteries of the Bones become leſs capacious; as is evident, 1. From the Bones of Adults having leſs Blood in them than thoſe of Children have. 2. From their becoming incapable in old Age of admitting the coloured Powders uſed in Injections, which eaſily paſs in Youth. And, 3. From the Bones of old Creatures being more difficultly tinged with Madder than thoſe of young

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(a) Philoſoph. Tranſact. Num. 442. Art. 8. Num. 443. Art. 2. Num. 457. Art. 4.—Mem. de l'Acad. des Sciences, 1739, 1742.

young ones.—If Authors have not miſtaken, the Arteries of Bones have ſometimes become very large (a).

Since the Veins of the *Perioſteum* are difficultly filled with a coloured Injection, we are not to expect that their Branches, the Veins of the Bones, can be ſhewn; for they are too ſmall to be ſeen without ſuch Aſſiſtance: But we may conclude from Arteries being accompanied with Veins ſo far as we can trace them in every other Part of the Body, that there are alſo Veins in the Bones; and the diſappearing of the Tincture of *Madder*, after Bones of living Animals are coloured with it, could not be without ſuch Veins to carry it away.

The Bones of a living Animal are ſo inſenſible, that they can be cut, raſped, or burnt, without putting the Creature to Pain, and the Nerves diſtributed in their Subſtance cannot be ſhewn by Diſſection; from which it might be inferred that they have no Nerves diſtributed to them: But the general Tenor of Nature, which beſtows Nerves to all the other Parts, ſhould prevent our drawing ſuch a Concluſion. And if Senſibility is a ſure Proof of Nerves entering into the Compoſition of any Part, as it is generally allowed to be, we have ſufficient Evidence of Nerves here in the Bones; for the granulated red Fleſh which ſprouts out from them, after an Amputation of a Limb, or performing the Operation of the *Trepan*, or after an *Exfoliation*, is exquiſitely ſenſible: And, in ſome Ulcers of Bones, where the *Perioſteum* was all ſeparated,

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(a) *Diemerbroek.* Anat. lib. 9. cap. 1.—*Mery.* Hiſt. de l'Acad. des Sciences, 1704.

parated, the Patient ſuffered racking Pain, if the Bone was touched with a rough Inſtrument; nor was he free of Pain after the Bone was perforated *(a)*.—The reaſon why the Nerves of rigid hard Bones become inſenſible, is, That all Nerves muſt have a conſiderable Degree of Flexibility at the Part where Objects are applied, otherwiſe it cannot be affected by their Impreſſions. We ſee this illuſtrated in a very common analogous Caſe, the Growth of a new Nail: When the former one has ſuppurated off, the thin Membrane which firſt appears, is exquiſitely ſenſible; but gradually becomes dull in its Senſation, till it can be cut or ſcraped, without cauſing Pain, after it is formed into a hard Nail.

From what has been ſaid of the Veſſels of Bones, it is evident, that there is a conſtant Circulation of Fluids in every Part of them; and that there is a perpetual Waſte and Renewal of the Particles which compoſe the ſolid Fibres of Bones, as well as of other Parts of the Body; the Addition from the Fluids exceeding the Waſte during the Growth of the Bones; the Renewal and Waſte keeping pretty near *par* in adult middle Age; and the Waſte exceeding the Supply from the Liquors in old Age; as is demonſtrable from their Weight: For each Bone increaſes in Weight, as a Perſon approaches to Maturity; continues of nearly the ſame Weight till old Age begins, and then becomes lighter. —The ſpecifick Gravity of the ſolid Sides, on the contrary, increaſes by Age; for then they become more hard, compact and denſe. In Conſequence

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(a) Nicol Maſſa lib. introd. Anat. cap. 30.

ſequence of this, the Bones of old People are thinner and firmer in their Sides, and have larger Cavities than thoſe of young Perſons.

The vaſcular Texture of Bones muſt make them ſubject to *Obſtructions*, *Ecchymoſes*, *Ulcers*, *Gangrenes*, and moſt other Diſeaſes which the ſofter Parts are affected with; and therefore there may be a greater Variety of *Caries* than is commonly deſcribed *(a.)*

Hence we can account for the following Appearances.

Hæmorrhagies from fungous Fleſh riſing out from the moſt ſolid Part of a cut Bone *(b.)*

The regular alternate Elevation and Subſiding or apparent Pulſation frequently to be ſeen in ſome of the Cells of a carious Bone.

Cells reſembling *Cancelli*, ſometimes ſeen in the Part of a Bone, which, in a natural State, is the moſt ſolid and firm *(c.)*

A Bone as a Tube including another Bone within it *(d.)*

On the internal Surface of the ſolid Parts of Bones, there are Orifices of Canals, which paſs outwards through the Plates to open into other Canals that are in a longitudinal Direction, from which other *tranſverſe* Paſſages go out to terminate in other *longitudinal* Canals; and this Structure is continued through the whole Subſtance of Bones, both theſe Kinds of Canals becoming ſmaller gradually as they approach the outer Surface.

(*a*) Edinburgh Medical Eſſays and Obſ. Vol. V. Art. 25.

(*b*) Medical Eſſays, Vol. IV. Art. 21.

(*c*) *Ruyſch.* Theſ. 8. Num. 8. Theſ. 10. Num. 176.

(*d*) Idem, ibid.

Surface (*a.*)—Theſe Canals are to be ſeen to the beſt Advantage in a Bone burnt till it is white: When it is broken tranſverſely, the Orifices of the *longitudinal* Canals are in View; and when we ſeparate the Plates, the *tranſverſe* ones are to be obſerved. Here however we are in Danger of believing both theſe Sorts of Canals more numerous than they really are; becauſe the Holes made by the Proceſſes connecting the Plates of Bones have the Appearance of the *tranſverſe* (*b*), and the Paſſages for the Blood-Veſſels reſemble the *longitudinal* Canals. I don't know how we are to keep free of Error about the *tranſverſe* Canals; but think we may diſtinguiſh between the two Kinds of *longitudinal* ones; for the Paſſages of the Veſſels are largeſt near the external Surface of the Bone, and every tranſverſe Section of them is circular; whereas the *longitudinal Canals* are largeſt near the *Cancelli*, and their tranſverſe Sections appear to me of a flat oval Figure, which may be owing to the different *Momentum* of the Fluids conveyed in them.—The Situation of the larger longitudinal Canals, and of the Paſſages of the larger Veſſels, makes a Bone appear more denſe and compact in the Middle of its ſolid Sides, than towards its outer and inner Surfaces, where it is ſpongy.

We ſee Marrow contained in the larger tranſverſe and longitudinal Canals juſt now deſcribed, and from thence judge that it paſſes alſo into the ſmaller ones. The Drops of Oil which we diſcover with a Microſcope every

where

(*a*) *Havers*, Oſteolog. nov. p. 43.

(*b*) *Morgagn.* Adverſ. 2. Animad. 25.

where on the Surface of a recent Bone fractured tranſverſly, and the ouſing of Oil through the moſt ſolid Bones of a Skeleton, which renders them greaſy and yellow, are a Confirmation of the Uſe of theſe Canals. Of what Advantage this Diſtribution of the Marrow through the Subſtance of Bones is, will be mentioned when the Nature and Uſe of this animal Oil is inquired into.

Moſt Bones have one or more large oblique Canals formed through their Sides for the Paſſage of the medullary Veſſels, which are to be deſcribed afterwards.

Bones expoſed to a ſtrong Fire in Chemical Veſſels, are reſolved, in the ſame Manner as the other Parts of Animals, into *Phlegm*, *Spirit*, *volatile Salt*, *fetid Oil*, and a black *Caput mortuum*. But the Proportion of theſe Principles varies according to the Age, Solidities, and other Circumſtances of Bones. Young Bones yield the largeſt Proportion of *Phlegm*; ſpongy Bones afford moſt *Oil*, and ſolid ones give moſt Salt and black *Reſiduum*.—Though this *Reſiduum* can ſcarce be changed by the Force of Fire while it is in cloſe Veſſels; yet, when it is burnt in an open Fire, the tenacious Oil, to which it owes its black Colour, is forced away, and a white Earth is left that has little or no fixed Salt in it; on which Account theſe Aſhes are the moſt proper Materials for forming into Veſſels that are to undergo the greateſt Force of Fire, being ſcarce capable of vitrifying by Fire, as moſt other earthy Subſtances do. This Earth ſeems to be the proper conſtituent ſolid Part of Bones, and the other Principles give it Firmneſs and Tenacity: For the Quantity of the Earth is ſo great, that, after all the other Principles are ſeparated from a Bone, its former Shape and Size remain *(a);* but it is very brittle till it is moiſtened with Water or Oil, when it recovers ſome Tenacity.——The Increaſe of the Proportion of Earth in old People's Bones is one Reaſon of their being more brittle than thoſe of young People are.

Leſt any imagine the Salts and Oils of Bones, while in a natural State, to be of the ſame acrid Kind with thoſe obtained from them by the Chemical Analyſis, it is to be obſerved, that theſe Principles may be extracted from Bones in the Form of a very mild Jelly, by boiling them in Water.

The Bones ſuſtain and defend the other Parts of the Body.

Bones are lined within, as well as covered externally with a Membrane; which is therefore commonly called PERIOSTEUM INTERNUM.

The *internal Perioſteum* is an extremely fine Membrane; nay frequently it has a looſe reticular Texture; and therefore it is compared by ſome to the *Arachnoid* Coat of the ſpinal Marrow: So that we cannot expect to divide it into Layers, as we can divide the *external Perioſteum.* We can however obſerve its Proceſſes entering into the tranſverſe Pores of the Bones, where probably they are continued to form the immediate Canals for the Marrow diſtributed thro' the Subſtance of the Bones; and along with them Veſſels may be ſent as from the external

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(a) *Havers,* Oſteolog nov. Diſc. I. p. 32.

Perioſteum, into the Bone (*a*). Theſe Proceſſes being of a very delicate Texture, the Adheſion of this Membrane to the Bone is ſo ſmall, that it ſeparates commonly more eaſily from the Bone than from the Marrow which it contains: Wherefore, one might call it the common Membrane of the Marrow, rather than by the Name it now has. But whether one or t'other Deſignation ought to be given it, is not worthy a Diſpute.

From the internal Surface of the internal *Perioſteum*, a great Number of thin Membranes are produced; which, paſſing a-croſs the Cavity, unite with others of the ſame Kind, and form ſo many diſtinct Bags, which communicate with each other; and theſe again are ſubdivided into communicating veſicular Cells, in which the Marrow is contained. Hence it is, that the Marrow, when hardened, and viewed with a Microſcope, appears like a Cluſter of ſmall Pearl; and that the hardened Marrow of Bones buried long under Ground, or laid ſometime in Water, and then dried, is granulous (*b*). This Texture is much the ſame with what obtains in the other cellular Parts of the Body, where Fat is collected; only that the Cells containing the Marrow are ſmaller than thoſe of the *Tunica adipoſa* or *celluloſa* elſewhere, which probably is owing to their being incloſed in the Bones, where they are not ſo much ſtretched or extended as in other Parts.

The MARROW is the oily Part of the Blood, ſeparated by ſmall Arteries, and depoſited in theſe

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(*a*) *Winſlow*, Expoſition Anat. des Os frais, § 82. 83.

(*b*) *Ruyſch.* Theſaur. 9. Num. 2. & Adverſ. Dec. III. Obſ. 9.

theſe Cells. Its Colour and Conſiſtence may therefore vary according to the State of the Veſſels, and their Diſtribution on the Membranes of the Cells.

Beſides the Arteries, which I mentioned already, *p.* 9. to be ſent from the Bones to the Marrow, there is at leaſt one Artery for each Bone; ſeveral Bones have more, whoſe principal Uſe is to convey and ſecern this oily Matter. After theſe Arteries have pierced the ſolid Side of a Bone, they are divided into ſeveral Branches; which ſoon are diſtributed every where on the internal *Perioſteum*, and afterwards ſpread their Branches on the medullary Cells.

The Blood, which remains after the Secretion of the Marrow, is returned by proper Veins, which are collected from the Membranes into one or two large Trunks, to paſs out at the ſame Holes or Paſſages at which the Artery or Arteries enter.

The general Rule of the ſmall Veſſels decreaſing in their Capacities as Animals advance in Age, to which many Phænomena in the Animal Oeconomy are owing, obtains here: For though the Trunks of the medullary Veſſels enlarge as Animals turn older; yet the ſmall Branches become ſmaller; as is evident from Injections, which cannot be made to paſs near ſo far in theſe Veſſels of Adults as of Children. Hence the Marrow is bloody in Children, oily and balmy in middle Age, and thin and watery in old People.

By Experiments made on the Marrow, when Bones of living Animals are opened or cut through *(a)*, and from the racking Pain with which Suppurations within Bones are frequently attended, we have ſufficient Proof, that the Membranes here are ſenſible, and conſequently have Nerves diſtributed to them. *Hippocrates (b)* might therefore ſay juſtly, that a Wound penetrating into the Cavity of a Bone may produce a *Delirium.*

The Veſſels of the Marrow, wrapt up in one common Coat from the *Perioſteum*, paſs through the Bones by proper Canals; the moſt conſiderable of which are about the Middle of each Bone, and are very oblique. Sometimes theſe Veſſels continue at a little Diſtance in their Paſſage, when the Canal is divided by a ſmall bony Partition or two.

From the Structure of the Contents of the Bones, we may judge how theſe Parts, as well as others, may be ſubject to Oidema, Phlegmon, Eryſipelas, Schirrhus, *&c.* and may thence be led to a Cure of each, before the common Conſequence, Putrefaction, takes Place, and frequently occaſions the Loſs of the Limb, if not of the Patient.

The Marrow is of very conſiderable Uſe to the Bones; for, by entering their tranſverſe Canals, and paſſing from them into the longitudinal ones, it is communicated to all the Plates, to ſoften and connect their Fibres, whereby they are preſerved from becoming too brittle; as we ſee they do in burnt Bones, or thoſe long expoſed to the Air; in People labouring under old Age, Pox or Scurvy: In all which Caſes, the Oil is either in too little Quantity, or has its natural good Qualities changed for worſe ones.

(a) *Du Verney*, Memoirs de l'Acad. des Sciences, 1700.
(b) Aphoriſm, § 7. Aph. 24.

Beſides this Advantage which the Subſtance of Bones has from the Marrow, their Articulations are ſaid *(a)* to receive no leſs Benefit from it: For it is thought that the Marrow paſſes into the articular Cavities, through the Holes which are in the Bones near the large Joints. And, as a Proof of this, it is alledged, that Butchers, upon ſeeing the greater or leſſer Quantity of Marrow in the Bones of Cows, can tell whether they have travelled far or little before they were ſlaughtered.

When the Marrow, after having ſerved the Uſes mentioned, is reaſſumed into the Maſs of Blood (as it is continually, in common with all other ſecreted Liquors that have not Paſſages formed for conveying them out of the Body) it corrects the too great Acrimony communicated to the ſaline Particles of our Fluids, by their Circulation and Heat; in the ſame manner as lixivial Salts are blunted by Oil in making Soap. Hence, in acute Diſeaſes, the Marrow, as well as the other Fat of the Body, is quickly waſted, but muſt be immediately ſupplied by Liquors from the Veſſels, ſeeing the Cells within the Bones, which have no Aſſiſtance to their Contraction from the Preſſure of the Atmoſphere, cannot collapſe, as the *Tela cellularis* under the Skin does, when the Liquor in its Cells is abſorbed, the Bones therefore are always full.

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(*a*) Joan. de Muralto Vade mecum, Anat. Exercit. V. § 3. Havers, Oſteolog. nov. Diſc. 3. *p*. 179.

Since it is the Nature of all Oil to become thin and rancid when expoſed long to Heat, and Bones have much Oil in their firm hard Subſtance, we may know why an ungrateful Smell, and dark coloured thin *Ichor*, proceed more from corrupted Bones, than from other Parts of the Body; and we can underſtand the Reaſon of the Changes of Colour which Bones undergo, according to their different Degrees of Mortification.——Hence likewiſe we may learn the Cauſe of a *Spina ventoſa*, and of the Difficulty of curing all *Caries* of Bones proceeding from an Obſtruction, and conſequent Putrefaction of the Marrow; and of the quick Pulſe, Thirſt, and *hectic Paroxyſms*, ſo often attending theſe Diſeaſes. Theſe *Phænomena* alſo teach us the Reaſon of the fatal *Prognoſis* taken from black fetid Urine in Fevers.

Though Bones ſo far agree in their Structure and annexed Parts, yet we may obſerve a conſiderable Difference among them in their Magnitude, Figure, Situation, Subſtance, Connexion, Uſes, *&c.* From which Authors have taken Occaſion to diſtinguiſh them into as many Claſſes as they could enumerate of theſe different Circumſtances. But theſe being obvious to every Perſon that looks on Bones, I ſhall only mention one of them; which comprehends very near the whole Bones of the Body, and at the ſame time leads us to examine the moſt conſiderable Variety that is to be found in the Diſpoſition of their conſtituent Parts, and in their Uſes. It is this, that ſome Bones are *broad* and *flat*, while others are *long* and *round*.

The *broad* Bones have thin Sides, by the Plates being ſoon and equally ſent off to form the Lattice-work; which therefore is thicker, and nearly of an equal Form all through. By this Structure, they are well adapted to their Uſes, of affording a large enough Surface for the Muſcles to riſe from, and move upon, and of defending ſufficiently the Parts which they incloſe.

The *round* Bones have thick ſtrong Walls in the Middle, and become very thin towards their Ends, which is owing to very few Plates ſeparating at their Middle; where, on that account, the *Cancelli* are ſo fine and ſmall, that they are not taken notice of: But ſuch Bones are ſaid to have a large Reſervoir of Oil in this Place. Towards their Ends the Lattice-work becomes very thick, and rather more compleat than in the other ſort of Bones.—Theſe round Bones having ſtrong Forces naturally applied to them, and being otherwiſe expoſed to violent Injuries, have need of a cylindrical Figure to reſiſt external Preſſure, and of a conſiderable Quantity of Oil to preſerve them from becoming too brittle. Beſides which, they are advantageouſly provided with thick Sides towards their Middle, where the greateſt Forces are applied to injure them; while their Hollowneſs increaſes their Diameter, and conſequently their Strength, to reſiſt Forces applied to break them tranſverſely (*a*). Thus, for Inſtance, in eſtimating the proportional Reſiſtance of two cylindrical Bones of unequal Diameters, but conſiſting

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(*a*) *Galilei.* Mechanic. Dialog. 2.

conſiſting of an equal Number of ſimilar Fibres uniformly diſpoſed round each, it is plain,

1. That the abſolute Force of theſe two Bones is equal, becauſe they conſiſt of equal Numbers of ſimilar Fibres.

2. That the abſolute Forces of all the Fibres in each Bone have the ſame Effect in reſiſting any Power applied to break them, as if the Sum of all their Forces was united in the reſpective Centers of the tranſverſe Sections where the Fractures are to be made. For, by Hypotheſis, the Fibres being uniformly diſpoſed in each, there is not any Fibre in either Bone that has not a correſponding Fibre; the Sum of both whoſe Diſtances from the Axis of Revolution (about which all the Parts of the Bone muſt revolve in breaking) is equal to two Semidiameters of the Bone: Conſequently each Fibre, and all the Fibres, may be regarded as reſiſting at the Diſtance of one Semidiameter or *Radius* from this Axis, that is, in the Center.

3. Since the united Force of all the Fibres is to be regarded as reſiſting at a Diſtance from the Center of Motion equal to the Semidiameter, it follows, that the total Reſiſtance of all theſe Fibres, or the Strength of the Bone is proportional to its Semidiameter, and conſequently to its Diameter.

I have here taken for an Example one of the moſt ſimple Caſes for calculating the proportional Forces of Bones. But, was it not too foreign to the preſent Deſign, it might be univerſally demonſtrated, that, of whatever Figure Bones are, and in whatever Manner their Fibres are diſpoſed, their Strength muſt always be in a

Ratio, compounded of the Area of their tranſverſe Sections, or of their Quantity of bony Matter, and of the Diſtance of the Center of Gravity of theſe Sections from the Center of Motion or Fulcrum, on which the Bone is ſuppoſed to be broken *(a)*.

Since therefore the Strength of Bones depends on their Number of Fibres, or Quantity of Matter, and the Largeneſs of their Diameters, one may conclude, that the Part of a Bone formerly fractured, and reunited by a *Callus*, muſt be ſtronger than it was before the Fracture happened; becauſe both theſe Advantages are obtained by a *Callus:* Which is a wiſe Proviſion, ſince Bones are never ſet in ſuch a good Direction as they were naturally of; and then where-ever a *Callus* is formed, there is ſuch an Obſtruction of the Veſſels, that if the Bone was again broken in the ſame Place, the *oſſifick* Matter could not ſo eaſily be conveyed to reunite it. This *Callus* may indeed, for Want of Compreſſion, be allowed to form into a ſpongy cellular Subſtance *(b)*; but even in this Caſe the Strength of the Bone is here increaſed by one or both the Cauſes above mentioned.

Many Bones have Protuberances, or *Proceſſes* *, riſing out from them. If a *Proceſs* ſtands out in a roundiſh Ball, it is called *Caput*, or *Head*.—If the Head is flatted, it obtains the

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(a) See the Demonſtration of this Theorem by Dr. *Porterfield* in the *Edinburgh Medical Eſſays*, Vol. I. Art. 10.

(b) *Ruyſch.* Theſaur. 8. n. 49. Muſ. Anat. Thec. B. Repoſit. 2. n. 2.

* Ἀπόφυσεις, ἔκφυσεις, ἐξοχὴ, προβολὴ, πρόβλημα, Exceſſus, Explanatio, Tuberculum, Gibbus, Eminentia, Productio, Extuberantia, Projectura, Enaſcentia.

Appellation of *Condyle.*——A rough unequal Protuberance, is called *Tuberoſity.*—When a *Proceſs* riſes narrow, and then becomes large, the narrow or ſmall Part is called *Cervix*, or *Neck.*——Long Ridges of Bones, are called *Spines.*——Such Proceſſes as terminate in a ſharp Point, have the general Name of *Coronæ**, or *Coronoid*, beſtowed on them, tho' moſt of them receive particular Names from the Reſemblance they have, or are imagined to have, to other Subſtances, *e. g. Maſtoid*, *Styloid*, *Anchoroid*, *Coracoid*, *Spinal*, *&c.*—Such Proceſſes as form Brims of Cavities, are called *Supercilia* †.

Proceſſes ſerve for the advantageous Origin and Inſertion of Muſcles, and render the Articulations firm and ſtable.

Before leaving this Subject, we muſt remark, that much the greater Number of what are called Proceſſes in adult Bones, diſcover themſelves in Children to be *Epiphyſes*, or diſtinct Bones, which are afterwards united to the other Parts; ſuch are the *Styloid* Proceſſes of the temporal Bones, Proceſſes of the *Vertebræ*, *Trochanters* of the Thigh, *&c.* However, as I deſign to inſiſt chiefly on the Deſcription of the adult Skeleton, in which the Union of theſe Parts is ſo intimate, that ſcarce any Veſtige remains of their former Separation, I ſhall retain the common Appellation of *Apophyſe*, or Proceſs, to all ſuch Protuberances; but ſhall remark the principal ones that have no juſt Title to this Name, when they occur in the Deſcription of particular Bones.

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* Roſtra, Glandes.

† Ἴτυες, ὄφρυες, ἄμβονες, χείλη, Labra.

On the Surfaces of a great many of the Bones, there are Cavities, or Depreſſions: If theſe are deep, with large Brims, Authors name them *Cotylæ**.——If they are ſuperficial, they obtain the Deſignation of *Glenæ*, or *Glenoid*. Theſe general *Claſſes* are again divided into ſeveral *Species*:——Of which *Pits* are ſmall roundiſh Channels ſunk perpendicularly into the Bone.—*Furrows*, are long narrow Canals, formed in the ſurface;—*Nitches*, or *Notches*, ſmall Breaches in the Bone; *Sinuoſities*, broad, but ſuperficial Depreſſions without Brims;——*Foſſæ*, large deep Cavities, which are not equally ſurrounded by high brims;—*Sinuſes*, large Cavities within the Subſtance of the Bones, with ſmall Apertures;——*Foramina*, or Holes, Canals that pierce quite through the Subſtance of the Bones.—When this laſt ſort of Cavity is extended any long Way within a Bone, the middle Part retains the Name of *Canal*, and its Ends are called *Holes*.

The Cavities allow the Heads of Bones to play in them; they lodge and defend other Parts; they afford ſafe Paſſage to Veſſels, Muſcles, *&c.* To mention more would engage us too much in the Hiſtory of particular Bones, which more properly belongs to the demonſtration of the *Skeleton*, where we ſhall have Occaſion to obſerve theſe ſeveral Species of Cavities.

To far the greater Number of Bones, whoſe Ends are not joined to other Bones by an immoveable Articulation, there are ſmaller ones annexed, which afterwards become ſcarce di-

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* Κοτυλίδες, ὀξυβάφοι, Acetabula, Pixides, Buccellæ.

ſtinguiſhable from the Subſtance of the Bone itſelf. Theſe are called *Epiphyſes*, or *Appendices**. Some Bones have one, others have two, three or four of theſe *Appendices* annexed by the Means of Cartilages, which are of a conſiderable Thickneſs in Children, but by Age become thinner; the Oſſification proceeding from the End of the Bone on one Side, and from the *Epiphyſes* on the other, till at laſt, in Adults, the Place of their Conjunction can ſcarcely be ſeen on the external Surface; and it is only ſometimes that we can then ſee any Mark of Diſtinction in the *Cancelli* (*a*).

Several Proceſſes (*e. g. Trochanters* of the Thigh, *Spine* of the *Scapula*, &c.) have *Epiphyſes*; and Proceſſes frequently riſe out from *Epiphyſes*; for Example, at the lower End of the *Femur*, *Ulna*, *Tibia*, &c. (*b*).

The *Epiphyſes* are united chiefly to ſuch Bones as are deſtin'd for frequent and violent Motion; and for this Purpoſe they are wiſely framed of a larger Diameter than the Bone they belong to; for by this Means, the Surface of Contact between the two Bones of any Articulation being increaſed, their Conjunction becomes firmer, and the Muſcles inſerted into them act with greater Force, by reaſon of their Axes being further removed from the Center of Motion. Theſe Advantages might indeed have been obtained by the Expanſion of the End of the Bone itſelf, to a Thickneſs equal to that of the *Epiphyſes;* but then the conſtant Separation of new Plates to form ſo wide a cellular Structure, muſt have left the ſolid Sides of the Bones ſo thin, as to yield eaſily, either to the Action of the Muſcles fixed to them, and paſſing over them, to the Weight ſeveral of them are obliged to ſupport, or to the Application of any other external Force.

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* Applantatio, Additamentum, Adnaſcentia, Adnexum, Perone.

(*a*) *Winſlow*, Expoſition Anatomique de Corps Humain Traite des Os ſecs, § 116.

(*b*) *Veſal.* De Human. Corp. fabrica, lib. 1. cap. 3.

Several Anatomiſts (*a*) thought that the *Epiphyſes* ſerve other Purpoſes; ſuch as, ſecuring the Ligaments of the Articulations which riſe out from between the Bones and them; for, as ſoon as theſe Parts are intimately joined, the Ligaments inſinuated betwixt them muſt have a much ſtronger Connexion than they could have to the ſmooth Surface of the Bones. Such an Interception of the Ligament between the Body of the Bone and its *Epiphyſe* is not to be ſeen, but as at this Place, the Bone remains longer ſoft than any where elſe, and the Adheſion of the *Perioſteum,* and of Ligaments to Bones, is always ſtronger in Proportion to the Bones being neareſt to the Conſiſtence of their Parts, which is being ſofteſt, their Opinion of the ſtronger Connexion of the Ligaments, where the Bones and *Epiphyſes* join, is not without Foundation.

Poſſibly too, by the Fibres of *Epiphyſes* not extending themſelves ſo longitudinally as thoſe of the Bones, there may be leſs Chance of the former running into each other, than of the latter.

(*a*) *Columb.* De re Anatomica, lib. 1. cap. 2.——*Fallop.* Expoſ. de Oſſibus, cap. 11.

The Softneſs of the Ends of Bones may be of ſome Advantage in the Womb, and at Birth, after which the Oſſification begins at differen Points to form *Epiphyſes*, before the Oſſification can extend from the Middle to the Ends of the Bones (*a*).

However ſolid and compact adult Bones are, yet they were once Cartilages, Membranes, nay, a mere Gelly. This needs no furthe Proof, than repeated Obſervations of *Embryos* when diſſected: And how much more tender muſt the Bones be before that Time, when neither Knife nor Eye is capable to diſcover the leaſt Rudiments of them? By Degrees they become more ſolid, then aſſume the Nature of Griſtles, and at laſt oſſify; the Coheſion of their Plates and Fibres always increaſing in Proportion to their increaſed Solidities; as is evident from the Time neceſſary to unravel the Texture of Bones of People of different Ages, or of denſe and of ſpongy Bones, or of the different Parts of the ſame Bone, and from the more tedious Exfoliations of the Bones of Adults than of Children.

After any Part of a Bone is fully oſſified, its Fibres are extended little more in Length at that Part, tho' they increaſe there in Thickneſs, and tho' their ſofter Parts continue to become longer (*b*).

As the Solidity of Bones increaſes, their *Perioſteum* more eaſily ſeparates from them. When Bones are membranous, the *Perioſteum* anc

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(*a*) *Haller* de ſtudio medic. p. 267.

(*b*) *Hale*'s vegetable Staticks, p. 393.——DuHamel Memoires de l'Acad. des Sciences 1742.

and they cannot be diſtinguiſhed; they appear to be the ſame Subſtance. When they are Cartilages, their Membrane adheres ſo firmly to them, that it is difficult to ſeparate them. Where the rigid bony Fibres are, the *Perioſteum* is eaſily taken off.——Is the Similarity of Structure and conſequent greater Attraction of the Membrane and Subſtance it incloſes, while they are both flexible, the Cauſe of their greater Adheſion then? or is it owing to the Veſſels, that go from the one to the other, being then larger? or do both theſe Cauſes combine to produce this Effect? Or is the Membrane or Cartilage, which becomes Bone afterwards, to be conſidered as the ſame Subſtance with the *Perioſteum* (a)? and muſt all theſe Plates of Bones be therefore ſaid to be Layers of the *Perioſteum* hardened (b)?

The Oſſification of Bones depends principally on their Veſſels being ſo diſpoſed, and of ſuch Diameters, as to ſeparate a Liquor, which may eaſily turn into a bony Subſtance, when it is deprived of its thinner Parts; as ſeems plain from the Obſervation of the callous Matter, ſeparated after Fractures and Ulcers, where Part of the Bone is taken out: For in theſe Caſes, the Veſſels extending themſelves, and the Liquors added to them, are gradually formed into granulated Fleſh; which fills up all the Space where the Bone is taken from; then hardens, till it becomes as firm as any other Part of the Bone. This happens frequently, even when the Ends of

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(a) Memoires de l'Acad. des Sciences, 1744.

(b) Memoires de l'Acad. des Sciences, 1743.

of the diſeaſed Bone are at a conſiderable Diſtance from each other *(a)*.

The Induration of Bones is alſo greatly aſſiſted by their being expoſed, more than any other Parts, to the ſtrong Preſſure of the great Weights they ſupport, to the violent Contraction of the Muſcles fixed to them, and to the Force of the Parts they contain, which endeavour to make Way for their own further Growth. By all this preſſing Force, the ſolid Fibres and Veſſels of Bones are thruſt cloſer; and ſuch Particles of the Fluids conveyed in theſe Veſſels as are fit to be united to the Fibres, are ſooner and more firmly incorporated with them, while the remaining Fluids are forcibly driven out by the Veins, to be mixed with the Maſs of Blood. In Conſequence of this, the Veſſels gradually diminiſh as the Bones harden. From which again we can underſtand one Reaſon, why the Bones of young Animals ſooner reunite after a Fracture, than thoſe of old, and why Cattle that are put too ſoon to hard Labour, ſeldom are of ſuch large Size as others of the ſame Brood who are longer kept from Labour.

That the oſſifying of Bones greatly depends on Preſſure, ſeems to be evinced from the frequent Examples we meet with of other Parts turning bony, when long expoſed to the preſſing Force of the ſurrounding Parts, or when they are ſubjected to the like Circumſtances by their own frequent and violent Contrac-

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(*a*) *Hildan.* de Vuln. graviſſ.—Med. Eſſays. Vol. I. Art. 23.—Job. a Meckren Obſ. 69.—Mem. de l'Acad. des Sciences 1742.—See a Collection of ſuch Caſes in Boehmer de Oſſium Callo.

tion. Witneſs, the Bones found frequently near the Baſe of the Heart in ſome old Men (*a*), and in ſeveral other Creatures. Nay, the muſcular Subſtance of the Heart has been oſſified in ſuch (*b*), and the Arteries of old Men often become bony.——The Cartilages of the *Larynx* are generally oſſified in Adults.—In Beaſts of Burden, the Cartilages between the *Vertebræ* of the Back very often change into compleat Bones; and, being intimately united with the *Vertebræ*, the whole appears one continued Bone—Nor is the *Perioſteum* exempted from ſuch an Induration (*c*).

To confirm this Argument ſtill further, we may obſerve, That Bones begin their Oſſification at the Places where they are moſt expoſed to theſe Cauſes, *viz.* in the cylindrical Bones from a middle Ring, and in the broad ones, at or near their Center, from one or more diſtinct Points. The Reaſon of which is, That theſe Parts are contiguous to the Bellies of the Muſcles annexed to the Bones, where the Swelling of theſe moving Powers is greateſt. What the Effects of this may be, let any judge, who view ſome of the Bones, as the *Scapula*, and *Oſſa Iliûm*, which are covered with Muſcles on each Side; how compact and thin they are in Adults, where the Bellies of the Muſcles were lodged; whereas in Children they are thicker. But

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(*a*) *Riolan.* Comment. de Oſſib. cap. 32.—*Bartholin.* Hiſt. medic. Cent. 1. Hiſt. 50.——Ibid. Cent. 2. Hiſt. 45.

(*b*) *Cheſelden*, Anatomy, Book 1. Introd.—*Garengeot*, Hiſt. de l'Acad. des Sciences, 1726.

(*c*) *Peyer.* Ephemerid. German. Decur. 2. Ann. 7. Obſerv. 205.

But this being the middle Part of theſe Bones, where the greateſt Number of Fibres is, this particular Place would have been much thicker in Adults, had not this forcible Cauſe been applied, which has not had ſuch Effects in Children, whoſe Muſcles have not been much exerciſed.—Beſides, if we allow that all the Parts of a Bone are equally increaſed by the conſtant Supply of new Particles, each Fibre, and every Particle of a Fibre, endeavours to make Way for its own Growth, by puſhing the one next to it; and conſequently by far the greateſt Preſſure is on the Middle, to make the Particles firm, and therefore to begin their Oſſification there. Laſtly, the Pulſation of the medullary Arteries, which enter the Bones near to this middle Part, may, as Authors have alledged, contribute perhaps ſomewhat to this Induration.

From the Effects of Preſſure only it is, that we can account for the Bones of old People having their Sides ſo much thinner, yet more denſe and ſolid, while the Cavities are ſo much larger, than in thoſe of young People; and for the Prints of Muſcles, Veſſels, *&c.* being ſo much more ſtrongly marked on the Surfaces of the former than of the latter, if they belong to People of near the ſame Condition in Life.—Preſſure muſt likewiſe be the Cauſe, which, in People of equal Ages, makes theſe Prints ſtronger in the Bones of thoſe who had much Labour and Exerciſe, than they are in People who have led an indolent unactive Life.

Perhaps both the Cauſes of Oſſification above mentioned, may be aſſiſted by the Nature of the Climate People live in, and the Food they uſe. Whence, in hot Countries, the Inhabitants ſooner come to their Height of Stature, than in the Northerly cold Regions: And thence ſeems to have ariſen the common Practice among the Ladies, of making Puppies drink Brandy or Spirit of Wine, and of bathing them in theſe Liquors, to prevent their growing big. Nay, it has been obſerved, that much Uſe of ſuch Spirits has occaſioned Parts, naturally ſoft, to petrify in ſome, and to oſſify in other People of no great Age (*a*).

From the foregoing Account of the Structure of Bones, and of their Oſſification, we may underſtand the Reaſons of the following Phænomena.

How Bones may be ſoftened or diſſolved.

How the natural Colour of Bones may be changed by ſome Sorts of Food (*b*).

Why the Bones of ſome People are ſo long in hardening, and in others never compleatly indurate.

Why, in ſuch whoſe Oſſification is ſlow, the Bones are generally thicker in Proportion to their Lengths, eſpecially at their Ends; as in the *Rickets*.

How hard firm Bones have become ſoft and pliable by Diſeaſes (*a*).

How

(*a*) *Littre*, Hiſtoire de l'Acad. des Sciences, 1706.—*Geoffroy*, Memoires de l'Acad. des Sciences, 1706.

(*b*) Philoſoph. Tranſact. 442. Art. 8. Num. 443. Art. 2. Num. 457. Art. 4. Mem. de l'Acad. des Sciences, 1739, 1742.

(*c*) Hiſtoire de l'Acad. des Sciences, 1700.—Mem. 1722.—*Gagliardi*, Anatom. oſſium, cap. 2. obſerv. 3.—Ephem. Germ. Decur. 1. ann. 1. obſ. 37. & Schol. Decur. 2. ann. 7. obſ. 212. 235. Decur. 3. ann. 2. obſ. 3.——Philoſ. Tranſ. No. 470. § 3. ibid. Vol. 48. § 4 and 44.

How Bones exfoliate by the riſing of granulated Fleſh from their Surface.

How Bones may waſte and diminiſh (*a*).

How Bones may become ſolid all through, without any Appearance of *Cancelli* (*b*).

Why in ſome Diſeaſes *Epiphyſes* ſeparate from Bones (*c*), and the End of Bones come aſunder many Years after their Fractures appeared to be cured (*d*).

How *Nodes*, *Tophi*, and *Exoſtoſes*, happen after the Eroſion of the external Plates of Bones in the *Lues Venerea*, *Scurvy*, *Rheumatiſm*, and *Gout*.

How and from what *Callus* is formed after a Fracture (*e*).

Why *Callus* appears to be rather the continued Subſtance of the *Perioſteum* than of the Bone, while it continues ſoft and flexible; but ſeems continued with the Bone after it oſſifies (*f*).

Why *Callus* is ſenſible, while it is ſoft, but becomes inſenſible when it hardens.

What occaſions ſometimes ſuch Difficulty in curing fractured Bones; or why they never reunite, though they are reduced, and all proper Means

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(*a*) *Cheſelden*, Anat. Book 1. Introd.—Hiſt. de l'Acad. des Sciences, 1700.

(*b*) *Ruyſch*. Theſaur. 2. Arc. 5. Theſ. 3. Loc. 1. Num. 5. Theſ. 9. Num. 2. not. 3.—Boehmer de Callo Oſſium.

(*c*) Memoires de l'Acad. des Sciences, 1699.—*Diemerbroek*, Anat. lib. 9. cap. 19.—*Cowper*'s Anat. Explic. Tab. 96. Fig. 1.

(*d*) *Anſon*'s Voyage.

(*e*) Memoires de l'Acad. des Sciences, 1741.—Dehtleef de Oſſium Callo.

(*f*) Mem. de l'Acad. 1741.

Means towards a Cure are uſed (*a*).—Are the Bones of a Woman with Child more tedious in reuniting, than thoſe of others (*b*)?

Why *Calluſes*, after Fractures, are ſometimes very thick and protuberant.

What Difference there ought to be in the Application of Bandages to Fractures of the Bones of old and of young Patients.

How Bones, remaining long unreduced after a Luxation, may have their Form ſo changed, as to make their Reduction very difficult, if not impoſſible (*c*).

Whoever is deſirous to know, in what Time and Order each Bone, and its ſeveral Parts, begin to aſſume a bony Nature, let him conſult *Kerckringius* (*d*), who gives us the Delineations of Abortions from three Days after Conception, and traces the Oſſification of the Bones from three Weeks, and a Month, till the Time of the Birth: To whom ſhould be added *Coiterus* (*e*), and *Evſſonius* (*f*). An Account of this Subject might alſo be collected out of *Ruyſch*'s Works, where ſome of the Miſtakes committed by the former Authors are corrected: And ſeveral more Particulars to make the Hiſtory of the

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(*a*) *Meckren.* Obſerv. Medico-Chirurg. Obſ. 71.—*Ruyſch.* dverſ. Dec. 2. § 2. Obſerv. Anat. Chir. obſ. 4.

(*b*) *Hildan.* Centur. 5. Obſ. 87. & Cent. 6. Obſ. 68.—hiloſ. Tranſact. No. 454. § 21.

(*c*) *Saltzman.* Obſerv. Decur. Obſ. 6.—Memoires de l'A-ad. de Chirurgic. Tome 2. p. 155.

(*d*) Anthropograph. Ichnograph. & Oſteogenea Fœtuum.

(*e*) De oſſibus fœtûs abortivi.

(*f*) De oſſibus Infant. cognoſcend. & curand.

the *Oſteogenea* more accurate, have ſince been added by *Neſbitt* (*a*) and *Albinus* (*b*).

I muſt refer to the Authors now quoted for the more curious Part of the human Oſteogeny; not having Preparations enough to give ſuch a full Hiſtory of it as is done by them. But I ſhall endeavour to explain the more uſeful and neceſſary Part of the Oſteogeny, by ſubjoining to the Deſcription of each Bone of an Adult, its Condition in ripe Children: that is, in ſuch as are born at the ordinary Time; and ſhall point out what Parts of each are afterwards joined in Form of *Epiphyſes*. This, with the following general Rules, ſeem to me ſufficient for underſtanding what of this Subject is neceſſary in the Practice of Phyſick and Surgery.

1. Where-ever I mention any Parts being cartilaginous, or their being ſtill ſeparable from the other Parts of the Bone to which they belong, I would be underſtood to hint, that, about ſeven or eight Years of Age, ſuch Parts are oſſified and united to their proper Bones, unleſs when it is ſaid, that they are afterwards formed into *Epiphyſes*.

2. Such as become *Epiphyſes*, are generally oſſified at ſeven or eight Years of Age; but, being for the moſt Part moiſtened by *Synovia*, their external Surface is ſtill ſomewhat cartilaginous, and they are not yet united to their Bones.

3. At eighteen or twenty Years of Age, the *Epiphyſes* are entirely oſſified, and have blended their

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(*a*) Human Oſteogeny explained.

(*b*) Icones oſſium fœtûs humani accedit oſteogeniæ brevi hiſtoria.

their Fibres ſo with the Body of the Bone, as to make them inſeparable without Violence.

The Knowledge of this Part of the *Oſteogeny*, I think neceſſary to prevent dangerous Miſtakes, in the Cure of ſeveral Diſeaſes. As for example: Without this Knowledge, the Separation of an *Epiphyſe* might be miſtaken for a Fracture or Luxation.——The interſtice of two Parts of a Bone not yet joined, might be judged to be a Fiſſure.——A *Diaſtaſis*, or Separation of ſuch disjoined Pieces of a Bone, might be thought a Fracture.—-The Protruſion of one Piece, or its overloping any other, could be miſtaken for an Excreſcence or *Exoſtoſis*.—Such Errors about the Nature of a Diſeaſe, would give one very different Indications of Cure, from what he would have, if he really underſtood his Patient's Caſe. And very often the Knowledge of the different Inequalities on the Surfaces of Bones, muſt direct us in the Execution of what is proper to be done to cure ſeveral of their Diſeaſes.

Having thus conſidered the Bones when ſingle, we ought next to ſhew the different Manner of their Conjunctions†. To expreſs theſe, Anatomiſts have contrived a great Number of technical Terms; about the meaning, Propriety and Claſſing of which, there has unluckily been Variety of Opinions. Some of theſe Terms it is neceſſary to retain, ſince they ſerve to expreſs the various Circumſtances of the Articulations, and to underſtand the Writers on this ſubject.

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† Σύνταξις, σύνθεσις, συμβολὴ, ὁμιλὶα, Compoſitio, Connexio, Articulatio, Conjunctio, Nodus, Commiſſura, Structura, Compages.

The ARTICULATIONS are moſt commonly divided into three Claſſes, *to wit*, *Symphyſis*, *Synarthroſis*, and *Diarthroſis*.

Symphyſis, which properly ſignifies the Concretion or growing together of Parts, when uſed to expreſs the Articulations of Bones, does not ſeem to comprehend, under the Meaning generally given to it, any thing relating to the Form or Motion of the conjoined Bones; but by it moſt Authors only denote the Bones to be connected by ſome other Subſtance; and as there are different Subſtances which ſerve this Purpoſe, therefore they divide it into the three following Species:

1. *Synchondroſis**, when a Cartilage is the connecting Subſtance: Thus the ribs are joined to the *Sternum;* thus the Bodies of the *Vertebræ* are connected to each other; as are likewiſe the *Oſſa Pubis*.

2. *Synneuroſis*, or *Syndeſmoſis*, when Ligaments are the connecting Bodies, as they are in all the moveable Articulations.

3. *Syſſarcoſis*, when Muſcles are ſtretched from one Bone to another, as they muſt be where there are moveable Joints.

The *ſecond* Claſs of Articulations, the *Synarthroſis*, which is ſaid to be the general Term by which the immoveable Conjunction of Bones is expreſſed, is divided into three Kinds.

1. The *Suture*‡ is that Articulation where two Bones are mutually indented into each other, or as if they were ſowed together, and is formed by the Fibres of two Bones meeting

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* Amphiarthroſis.

‡ Ῥαφὴ,

while they are yet flexible and yielding, and have not come to their full Extent of Growth; ſo that they mutually force into the Interſtices of each other, till, meeting with ſuch Reſiſtance as they are not able to overcome, they are ſtopped from ſprouting out farther, or are reflected; and therefore theſe Indentations are very different both in Figure and Magnitude: Thus the Bones of the Head are joined; thus *Epiphyſes* are joined to the Bones, before their full Connexion and Union with them.

Under this Title of *Suture*, the *Harmonia* of the Antients may be comprehended; ſcarce any unmoved Bones being joined by plain Surfaces (*a*).

2. *Gomphoſis* * is the fixing one Bone into another, as a Nail is fixed in a Board: Thus the Teeth are ſecured in their Sockets.

3. *Schindyleſis* or *Ploughing (b)*, when a thin *Lamella* of one Bone is received into a long narrow Furrow of another: Thus the *Proceſſus azygos* of the *Sphenoid*, and the naſal Proceſs of the *ethmoid* Bone, are received by the *Vomer*.

The *third* Claſs, or *Diarthroſis* ||, is the Articulation where the Bones are ſo looſely connected as to allow large Motion. This is ſubdivided into three Kinds.

The firſt is *Enarthroſis*, or the Ball and Socket, when a large Head is received into a deep Cavity; as the Head of the *Os Femoris* is into the *Acetabulum Coxendicis*.

(*a*) *Veſal.* Obſerv. *Fallop.* Examen.

[*] Conclavatio.

(*b*) *Keil*, Anat. chap. 5. § 3.

[||] Απαρθρώσις, Dearticulatio, Abarticulatio.

The ſecond is *Arthrodia*, when a round Head is received into a ſuperficial Cavity; as in the Articulation of the Arm-bone and *Scapula*. Theſe two Species of *Diarthroſis* allow Motion to all Sides.

The third is *Ginglimus* §, which properly ſignifies the Hinge of a Door or Window; in it the Parts of the Bones mutually receive and are received, and allow of Motion two Ways: Workmen call it *Charnal*.

The *Ginglimus* is generally divided into three Kinds, to which ſome (*a*) give the Names of *contiguous* †, *diſtant* ‡, and *compound* ||.

The firſt Kind of *Ginglimus* is, when a Bone has ſeveral Protuberances and Cavities, which anſwer to as many Cavities and Proceſſes of the other Bone, with which it is articulated; as in the Conjunction of the *Femur* with the *Tibia*.

The ſecond Species is, when a Bone receives another at one End, and is received by the ſame Bone at the other End; as in the *Radius* and *Ulna*.

The laſt Sort is, when a Bone receives another, and is received by a third; as in the oblique Proceſſes of the *Vertebræ*.

When I firſt mentioned the Articulations of Bones, I ſaid there were different Opinions concerning the Uſe of their technical Names, *e. g.* It has been ſaid, that *Symphyſis* ſhould be the Name for the immoveable Articulations, and that

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§ Articulatio mutua.

(*a*) *Baker*, Curſ. Oſteolog. Demonſtr. 1.

† Proximus.

‡ Longus.

|| Compoſitus.

that by *Synarthroſis* ſhould be underſtood the Conjunction of Bones by ſome connecting *Medium.*——Thoſe who have taken *Symphyſis* in the Senſe I did, of its expreſſing the Conjunction of Bones with a connecting Subſtance, have diſagreed in their Definition of it; ſome inſerting, and others leaving out, its allowing Motion.—Where they have agreed in their Definition, they have not been of the ſame Mind concerning the Species of it. For ſeveral think the *Syſarcoſis* and *Syndeſmoſis* applicable to ſo many Joints which are univerſally allowed to be claſſed under the *Diarthroſis*, that it muſt create Confuſion to name them by any Species of the *Symphyſis.*——Few keep to ſuch a general Definition of the *Synchondroſis* as I have done; and, whether they determine it to allow no Motion, or an obſcure or a manifeſt one, bring themſelves into Difficulties, becauſe there are Examples of all theſe three Kinds.——Some again, by too nicely diſtinguiſhing obſcure and manifeſt Motions of Bones, have blended the *Synarthroſis* and *Diarthroſis*, and from thence have branched out the different compound Species of Articulations that may be formed of them ſo far, that they could find no Examples in the Body to illuſtrate them by.—It would be tedious to enumerate more of the jarring Opinions, and it would be far more ſo to give a Detail of the Arguments uſed by the Diſputants. It is ſufficient for my Purpoſe, that it is underſtood in what Senſe I take theſe technical Terms; which I do in the following Manner.

When I mention the *Symphyſis* or *Synarthroſis*, or any Species of them, I ſhall always underſtand them according to the Explication already given of them. But though the preceeding Account of the *Diarthroſis*, or Articulation of moveable Bones, has been almoſt univerſally received; yet ſeeing it does not comprehend all the moveable Articulations of the Body, and one of its Species does not anſwer to any Notion we can have of the Conjunction of two Bones, I muſt beg Leave to change the Definitions and Kinds of theſe Joints.

I would call *Diarthroſis* that Conjunction of Bones, whereby they are fitted for Motion, being each covered with a ſmooth Cartilage, connected by one or more common Ligaments, and lubricated with Liquor at the conjoined Parts. In which Definition, I have no Regard to the Quantity of Motion which they really do perform; the Motion being often confined or enlarged by ſome other Cauſe not immediately depending on the Frame of the two Surfaces of the Bones, forming the particular Joint, which then is conſidered.

The firſt Species of the *Diarthroſis*, *viz.* the *Enarthroſis* or Ball and Socket, I would define more generally than above, That Articulation where a round Head of one Bone is received into a Cavity of another, and conſequently, without ſome foreign Impediment, is capable of Motion to all Sides. Examples of this Kind are to be ſeen in the Articulation of the Thigh-bone and *Oſſa innominata;* Arm-bone and *Scapula; Aſtragalus* and *Os Naviculare ; Magnum* of the Wriſt, with the *Scaphoides* and *Lunare;* firſt Bone of the Thumb with the ſecond, *&c.*

The ſecond Sort, or the *Arthrodia*, differing from the *Enarthroſis*, in the preceeding Account, only in the Cavity's being more ſuperficial, which makes no eſſential Difference, eſpecially that, in the recent Subject, Cartilages or Ligaments ſupply the Deficiency of Bone, ought, in my Opinion, to be called, with *Veſalius (a)*, that Articulation of two Bones adapted for Motion, where it is not at firſt Sight obvious which of the two has the Head or Cavity, or where they are joined by plain Surfaces, or nearly ſo; ſuch is the Conjunction of the *Clavicle* with the *Scapula; Oſſa Cuneiformia* with the *Os Naviculare; Metatarſal* Bones with the *Oſſa Cuneiformia, &c.* From the Nature of this Sort of Joint, it is plain, that very great Motion cannot be allowed, without the Bones going farther out of their natural Situation, than is convenient or ſafe.

Ginglimus, I would reckon that Articulation by the Form of which the Motion of the joined Bones muſt be chiefly confined to two Directions, which Hinges of Doors are.

The firſt Species of this is the *Trochoides*, when one Bone turns on another, as a Wheel does on its Axis: Thus the firſt *Vertebra* of the Neck moves on the Tooth-like Proceſs of the ſecond. This is the moſt proper Kind of *Ginglimus*.

The ſecond Species ſhould be eſteemed that Articulation, where ſeveral prominent and hollow Surfaces of two Bones move on each other, within the ſame common Ligament; as in the Knee, Elbow, *&c.*

(a) De corp. human. fabrica, lib. 1. cap. 4.

The third Sort of *Ginglimus* is, when two Bones are articulated to each other at different Parts, with a diſtinct *Apparatus* of the motory Machines at each; ſuch is the Articulation of the *Os Occipitis* with the firſt *Vertebra* of the Neck, of any two contiguous *Vertebræ* by their oblique Proceſſes, of the Ribs with the Bodies and tranſverſe Proceſſes of the *Vertebræ*, of the *Radius* with the *Ulna*, *Tibia* with the *Fibula*, *Aſtragalus* with the *Calcaneum*, *&c.*

I would entirely throw out what is commonly called the third Kind of *Ginglimus*: For, in examining the Conjunction of a Bone with two others, as in the common Example of a *Vertebra* joined with the one above and below, the Connexion of the middle one with each of the other two, ought to be conſidered ſeparately; otherwiſe we might with the ſame Propriety eſteem the Articulations that the long Bones, the *Femur*, *Tibia*, *Humerus*, *&c.* have at their different Ends, as one Articulation; which is abſurd.

If the moveable Bones were not connected and kept firm by ſome ſtrong Subſtance, they would be luxated at every Motion of the Joints; and if their hard rough unequal Surfaces were to play on each other, their Motion would not only be difficult, but the Loſs of Subſtance from Attrition would be great: Therefore *Ligaments* are made to obviate the firſt, and *Cartilages* to prevent the other Inconveniency. But becauſe Ligaments and Cartilages turn rigid, inflexible and rough, unleſs they are kept moiſt, a ſufficient Quantity of proper Liquors is ſupplied for their Lubrication, and to preſerve them in a

flexible

lexible State. Seeing then theſe Parts are ſo ieceſſary to the Articulations, I ſhall next conider their Structure, Situation and Uſes, ſo far as hey are ſubſervient to the Bones, and their Moions.

LIGAMENTS || are white flexible Bodies, hicker and firmer than Membranes, and not ſo iard or firm as Cartilages, without any remarkble Cavity in their Subſtance, difficultly ſtretched, and with little Elaſticity; ſerving to connect one Part to another, or to prevent the Parts to vhich they are fixed from being removed out of hat Situation, which is uſeful and ſafe.

After Maceration in Water, the Ligaments can eaſily be divided; and each ligamentous Layer appears compoſed of Fibres, the largeſt f which are diſpoſed in a longitudinal Direcion.

The *Arteries* of Ligaments are very conſpicuous after a tolerable Injection, and the larger Trunks of their Veins are ſometimes to be ſeen ull of Blood.

Such Ligaments as form the Sides of Caviies, have numerous Orifices of their Arteries pening upon their internal Surface, which keep t always moiſt: If we rub off that Moiſture, nd then preſs the Ligament, we can ſee the Liquor ouſing out from ſmall Pores; and we can orce thin Liquors injected by the Arteries, into he Cavities formed by Ligaments.

Theſe exhalant Arteries muſt have correſpondng abſorbent *Veins*, otherwiſe the Cavities vould ſoon be too full of Liquor.

Ligaments

|| Σύνδεσμοι, νεῦροι, Copulæ, Vincula.

Ligaments then muſt be ſubject to the Diſeaſes common to other Parts, where there is a Circulation of Fluids, Allowance always being made for the Size of Veſſels, Nature of the Fluids, and Firmneſs of the Texture of each Part.

Authors generally ſay, That Ligaments are inſenſible; and conſequently it may be inferred, that they have no Nerves beſtowed on them. But the violent racking Pain felt on the leaſt Motion of a Joint labouring under a *Rheumatiſm*, the Seat of which Diſeaſe ſeems often to be in the Ligaments, and the inſufferable Torture occaſioned by Inciſions of Ligaments, and by a Collection of acrid Matter in a Joint, or by *Tophi* in the Gout, would perſuade us, that they are abundantly ſupplied with Nerves.

The Ligaments, which connect the moveable Bones, commonly riſe from the Conjunction of the *Epiphyſes* of the one Bone, and are inſerted into the ſame Place of the other; or where *Epiphyſes* are not, they come out from the *Cervix*, and beyond the *Supercilia* of the articulated Bones; and after ſuch a Manner, in both Caſes, as to include the Articulation in a Purſe or Bag, with this Difference, depending on their different Motions, that where the Motion is only to be in two Directions, the Ligaments are ſtrongeſt on thoſe Sides towards which the Bones are not moved; and when a great Variety of Motions is deſigned to be allowed, the Ligaments are weaker than in the former ſort of Articulations, and are nearly of the ſame Strength all round.

Part of the capſular Ligaments is compoſed f the *Perioſteum*, continued from one Bone to nother, as was obſerved P. 2. and their inter- al Layer is continued on the Parts of the Bone r Cartilage which the Ligament includes (*a.*)

Beſides theſe common capſular Ligaments f the Joints, there are particular ones in ſe- eral Places, either for the firmer Connexion f the articulated Bones, or for reſtraining nd confining the Motion to ſome one Side; ch are the *croſs* and lateral Ligaments of the nee, the *round* one of the Thigh, *&c.*

From this Account of the Ligaments, we ay conclude, that, *cæteris paribus*, in what- ver Articulation, the Ligaments are few, long d weak, the Motion is more free and quick; t Luxations happen frequently: And, on the ntrary, where the Ligaments are numerous, ort and ſtrong, the Motion is more confined; t ſuch a Joint is leſs expoſed to Luxations).——Whence we may judge how neceſſary is to attend to the different Ligaments, and e Changes which have been made on them a Luxation, when it is to be reduced.

Ligaments alſo ſupply the Place of Bones in veral Caſes to Advantage: Thus the Parts in e *Pelvis* are more ſafely ſupported below by gaments, than they could have been by ne.——The Ligaments, placed in the great les of the *Oſſa innominata*, and between the nes of the Fore-arm and Leg, afford conve- ent Origin to Muſcles.—Immoveable Bones are,

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a) Neſbit. Oſteogen.—Philoſ. Tranſact. No. 470. §. 6.
b) *Fabric. ab Aquapend.* de Articul. Part. utilit. Pars 3.

are firmly connected by them; of which th Conjunction of the *Os ſacrum* and *innominatum* is an Example.—They afford a Socket fo moveable Bones to play in, as we ſee Part o the *Aſtragalus* does on the Ligament ſtretch ed from the Heel-bone to the *Scaphoid.*

Numerous Inconveniencies may ariſe fron too long or ſhort, ſtrong or weak, lax or rigi Ligaments.

CARTILAGES (*a*) are ſolid, ſmooth, white elaſtick Subſtances, between the Hardneſs o Bones and Ligaments, and covered with Membrane, named *Perichondrium*, which is o the ſame Structure and Uſe to them, as the *P rioſteum* is to the Bones.

Cartilages are compoſed of Plates, which ar formed of Fibres, diſpoſed much in the ſam Way as thoſe of Bones are; as might be rea ſonably concluded, from obſerving Bones in cartilaginous State before they oſſify, and fron ſeeing, on the other Hand, ſo many Cartilage become bony. This may be ſtill farther co firmed, by the *Exfoliation* which Cartilages a ſubject to, as well as Bones.

The *Perichondrium* of ſeveral Cartilages, fo Example, thoſe of the Ribs and *Larynx*, h Arteries which can be equally well injecte with thoſe of the *Perioſteum*, but the Veſſels that Membrane in other Parts, *e. g.* the art cular Cartilages, do not admit the coloured I jections, and in none of them does the Inject on enter deep into the Subſtance of the Cart lage; nay, Madder, mixed with the Food Animal

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(*a*) Χονδροί.

Animals, does not change the Colour of Cartilages, as it does of Bones *(a)*.

The granulated Fleſh which riſes from the Ends of metarcarpal or metatarſal Bones, when the Cartilage exfoliates, after a Finger or Toe has been taken off at the firſt Joint, is very ſenſible, from which the Exiſtence of Nerves in Cartilages may be inferred.

While Cartilages are in a natural State, it is to be remarked, *firſt*, That they have no Cavity in their Middle for Marrow. *Secondly*, That their outer Surface is ſofteſt, which renders them more flexible. *Thirdly*, That they do not appear to change their Texture ſo much by Acids as Bones do. And, *laſtly*, That, as the ſpecifick Gravity of Cartilages is near a third leſs than that of Bones; ſo the Coheſion of their ſeveral Plates is not ſo ſtrong as in Bones: Whence Cartilages laid bare in Wounds or Ulcers, are not only more liable to corrupt, but exfoliate much ſooner than Bones do.

Cartilages ſeem to be principally kept from oſſifying, either by being ſubjected to alternate Motions of Flexion and Extenſion, the Effects of which are very different from any Kind of ſimple Preſſure, or by being conſtantly moiſtened *(b)*: Thus, the Cartilages on the articulated Ends of the great Bones of the Limbs, and the moveable ones placed between the moving Bones in ſome Articulations, which are obliged

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(a) Philoſ. Tranſact. No. 442. Art. 8. No. 443. Art. 2. No. 457. Art. 4.—Mem. de l'Acad. des Sciences 1739 & 742.—Dehtleef de Oſſium Callo.

(b) *Havers's* Oſteolog. nov.

to ſuffer many and different Flexions, and are plentifully moiſtened, ſcarce ever change into Bone; while thoſe of the Ribs and Larynx are often oſſified.——The middle angular Part of the Cartilages of the Ribs, which is conſtantly in an alternate State of Flexion and Extenſion, by being moved in Reſpiration, is always the laſt of becoming bony.—In the *Larynx*, the *Epiglottis*, which is oftener bended and more moiſtened than the other four Cartilages, ſeldom is oſſified, while the others as ſeldom eſcape it in Adults.

Cartilages, which have little Flexion or Moiſture, ſuch as thoſe of the Ribs or *Larynx*, often begin to oſſify on their external Surface, and the Oſſification proceeds internally, till the *Cancelli* are at laſt formed, when Marrow is depoſited into them. While this Change is a bringing about in the Subſtance of Cartilages, their Blood-veſſels gradually appear bigger towards their internal Subſtance. This Change of a Cartilage from a natural State, to its becoming Bone, is at firſt View ſurpriſing; and, ſo far as I know, none has attempted to explain it; which I mention only, to have ſome Plea for an Apology, if I ſhould be thought to have failed in accounting for this *Phænomenon.*

The Cartilages, being naturally of a firm Subſtance, and of a Compoſition a-kin to that of Bones, gradually acquire greater Solidity by conſtant Preſſure; and this Change is made ſooneſt and moſt remarkably where the Preſſure is greateſt; that is, at their external Surface.—The exterior Plates, when oſſified, are more compact and denſe than formerly, and therefore have a ſtronger Power of attracting thoſe in Contact with them; while the Branches of Veſſels diſtributed to the firſt oſſified Plate, and thoſe that run in the Interſtices of the Fibres of this and of the Plate next to it, being now more compreſſed than formerly, have a leſs Quantity of Fluids paſſing through them; and, conſequently, the other Branches receive a proportionally larger Quantity; the *Momentum* of which, joined to that Power of Attraction or Force of Coheſion, increaſed by the greater Solidity of the Plates, increaſes the Preſſure upon the more internal Plates, and haſtens their Hardening; after which theſe laſt Plates produce the ſame Effects on the others contiguous to them: And thus the Oſſification goes on, till all are become bony.—The Body thus changed, has its former Dimenſions, or nearly ſo; becauſe its external Part oſſified firſt, and being rigid, yields little or nothing to the Powers that draw it towards the Axis of the Bone. But ſeeing the new Particles, added from the circulating Fluids, during the Oſſification, do not compenſate for the Condenſation which all the Particles undergo, and thereby the Plates occupy leſs Space than they did while in a cartilaginous State, a Cavity is left in the Middle. And as all the Plates cohered, and had croſs Fibres joining them, many of theſe Fibres are ſtretched irregularly from one Side of the Cavity to the other, and therefore form *Cancelli*.—The Branches of the Veſſels formerly diſtributed to the Plates being now much leſſened, the remaining Branches, which run tranſverſely, are conſequently proportionally

increaſed,

increaſed, become very conſpicuous, and are diſperſed every where in the Cavity, to ſerve for the Secretion of Marrow.—Thus, this flexible elaſtick ſolid Subſtance, becomes a rigid inflexible cavernous Bone, with Marrow contained in its *Cancelli.*

The Cartilages ſubſervient to Bones, are ſometimes found on the Ends of Bones which are joined to no other; but are never wanting on the Ends, and in the Cavities of ſuch Bones as are deſigned for Motion (*a*). Cartilages alſo are interpoſed between ſuch other Cartilages as cover the Heads and Cavities of articulated Bones; nay, they are alſo placed between immoveable Bones.

The Uſes of Cartilages, ſo far as they regard Bones, are, to allow, by their Smoothneſs, ſuch Bones as are deſigned for Motion, to ſlide eaſily without Detrition, while, by their Flexibility, they accommodate themſelves to the ſeveral Figures neceſſary in different Motions, and, by their Elaſticity, they recover their natural Poſition and Shape, as ſoon as the Preſſure is removed.——This ſpringy Force may alſo aſſiſt the Motion of the Joint to be more expeditious, and may render Shocks in running, jumping, *&c.* leſs. — To theſe Cartilages we chiefly owe the Security of the moveable Articulations: For without them the bony Fibres would ſprout out, and intimately coaleſce with the adjoining Bone; whence a true *Anchyloſis* muſt neceſſarily follow; which never fails to happen when the Cartilages are eroded by acrid

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(*a*) *Celſ.* de re Medic. lib. 8. cap. 1.

crid Matter, or oſſified from Want of Motion or Defect of Liquor, as we ſee often happens after Wounds of the Joints, *Paidarthrocace*, *Scrophula*, and *Spina ventoſa*, or from old Age, and long Immobility of Joints *(a)*.—Hence we may know what the Annihilation is, which is ſaid to be made of the Head of a Bone, and of the Cavity for lodging it, after an unreduced Fracture *(b)*. The moveable Cartilages interpoſed in Joints, ſerve to make the Motions both freer and more ſafe than they would otherwiſe be.—Thoſe placed on the Ends of Bones that are not articulated, as, on the *Spine* of the *Os Iliûm*, Baſe of the *Scapula*, *&c.* ſerve to prevent the bony Fibres from growing out too far.—Cartilages ſometimes ſerve as Ligaments, either to faſten together Bones that are immoveably joined, ſuch are the Cartilages between the *Os ſacrum*, and *Oſſa Iliûm*, the *Oſſa Pubis*, *&c.*, or to connect Bones that enjoy manifeſt Motion, as thoſe do which are placed between the Bodies of the true *Vertebræ*, *&c.* — Cartilages very often do the Office of Bones to greater Advantage than theſe laſt could; as in the Cartilages of the Ribs, thoſe which ſupply Brims to Cavities, *&c.*

Too great Thickneſs or Thinneſs, Length or Shortneſs, Hardneſs or Suppleneſs of Cartilages, may therefore cauſe great Diſorders in the Body.

(*a*) *Columb.* de re anat. Lib. XV.—Deſlandes Hiſt. de l'Acad. des Sciences 1716.—Phil. Tranſact. No. 215.—Ibid. No. 461. § 16.

(*b*) *Hildan.* de Ichor. et Melicer. acri Celſi, cap. 5.—*Ruyſch.* Theſ. 8. No. 103.—*Saltzman* in Act. Petropolit. Tom. 3. p. 275.

The Liquor, which principally ſerves to moiſten the Ligaments and Cartilages of the Articulations, is ſupplied by Glands, which are commonly ſituated in the Joint, after ſuch a Manner, as to be gently preſſed, but not deſtroyed by its Motion. By this Means, when there is the greateſt Neceſſity for this Liquor, that is, when the moſt frequent Motions are performed, the greateſt Quantity of it muſt be ſeparated. Theſe Glands are ſoft and pappy, but not friable: In ſome of the large Joints they are of the conglomerate Kind, or a great Number of ſmall Glandules are wrapt up in one common Membrane. Their excretory Ducts are long, and hang looſe, like ſo many Fringes, within the Articulation; which, by its Motion and Preſſure, prevents Obſtructions in the Body of the Gland, or its Excretories, and promotes the Return of this Liquor, when fit to be taken up by the abſorbent Veſſels, which muſt be in the Joints, as well as in the other Cavities of the Body; and, at the ſame Time, the Preſſure on the excretory Ducts hinders a ſuperfluous unneceſſary Secretion, while the fimbriated Diſpoſition of theſe Excretories does not allow any of the ſecreted Liquor to be puſhed back again by theſe Canals towards the Glands *(a)*.

Very often theſe Fountains of ſlimy Liquor appear only as a Net-work of Veſſels.—Frequently they are almoſt concealed by cellular Membranes containing the Fat—and ſometimes ſmall ſimple mucous *Folliculi* may be ſeen *(b.)*

The

(a) Cowper, Anatomy Explicat. tab. 79. litt. E. E.

(b) Morgagn. Adverſat. 2. Animad. 23.

The different Joints have theſe Organs in different Numbers and Sizes; the conglomerate ones don't vary much, eſpecially as to Situation, in the ſimilar Joints of different Bodies, but the others are more uncertain.

Upon preſſing any of theſe Glands with the Finger, one can ſqueeze out of their Excretories a mucilaginous Liquor, which ſomewhat reſembles the White of an Egg, or *Serum* of the Blood; but it is manifeſtly Salt to the Taſte. It does not coagulate by Heat, as the *Serum* does; but turns firſt thinner, and, when evaporated, leaves only a thin ſalt Film. Different Salts have much the ſame Effect on it as on many other Juices of our Body.

The Quantity of this *Mucilage*, conſtantly ſupplied, muſt be very conſiderable, ſince we ſee what a plentiful troubleſome Diſcharge of glary Matter follows a Wound or Ulcer of any Joint; of which Liquor the Mucilage is a conſiderable Part.

The Veſſels which ſupply Liquors for making the Secretion of this Mucilage, and the Veins which bring back the Blood remaining after the Secretion, are to be ſeen without any Preparation; and, after a tolerable Injection of the Arteries, the Glands are covered with them.

In a ſound State, we are not conſcious of any Senſibility in thoſe Glands; but, in ſome Caſes which I have ſeen, when they inflame and ſuppurate, the moſt racking Pain is felt in them: A melancholly, tho' a ſure Proof that they have Nerves.

Theſe mucilaginous Glands are commonly lodged in a cellular Subſtance; which is alſo to be obſerved in other Parts of the Bag formed by the Ligaments of the Articulation; and contains a fatty Matter, that muſt neceſſarily be attenuated, and forced through the including Membranes into the Cavity of the Joint, by the Preſſure which it ſuffers from the moving Bones.

If then the Oil is conveyed from this cellular Subſtance; and if the attenuated Marrow paſſes from the *Cancelli* of the Bones by the large Pores near their Ends, or in their Cavities, and ſweats through the Cartilages there into the Articulations; which it may, when aſſiſted by the conſtant Heat and Action of the Body, more eaſily do, than when it eſcapes through the compact Subſtance of the Bones in a Skeleton: If, I ſay, this Oil is ſent to a Joint, and is incorporated with the Mucilage, and with the fine Lymph that is conſtantly ouſing out at the Extremities of the ſmall Arteries diſtributed to the Ligaments, one of the fitteſt *Liniments* imaginable muſt be produced; for the *Mucus* diluted by the Lymph contributes greatly to its Lubricity, and the Oil preſerves it from hardening. How well ſuch a Mixture ſerves the purpoſe it is deſigned for, *Boyle* (*a*) tells us he experienced in working his Air-pump; for the Sucker could be moved with much leſs Force after being moiſtened with Water and Oil, than when he uſed either one or other of theſe Liquors: And I believe

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(*a*) Phyſico-mechanic. Experim.

lieve every one, at firſt View, will allow the diluted Mucilage to be much preferable to ſimple Water. The *Synovia*,[†] as this Liquor compoſed of Oil, Mucilage and Lymph, is commonly now called, while in a ſound State, effectually preſerves all the Parts concerned in the Articulations ſoft and flexible, and makes them ſlide eaſily on each other, by which their mutual Detrition and Overheating is prevented, in the Manner daily practiſed in Coach and Cart Wheels, by beſmearing them with Greaſe and Tar.

After the Liquor of the Articulations becomes too thin and unſerviceable, by being conſtantly pounded and rubbed between the moving Bones, it is reaſſumed into the Maſs of Blood by the abſorbent Veſſels.

When the *Synovia* is not rubbed betwixt the Bones, it inſpiſſates. And ſometimes, when the Head of a Bone has been long out of its Cavity, this Liquor is ſaid to fill up the Place of the Bone, and hinder its Reduction; or if a Joint continues long unmoved, it is alſo ſaid to cement the Bones, and occaſion a true *Anchyloſis* (a).——If the *Synovia* becomes too acrid, it erodes the Cartilages and Bones; as frequently happens to thoſe who labour under the *Lues Venerea*, *Scurvy*, *Scrophulæ*, or *Spina ventoſa*.—If this Liquor is ſeparated in too ſmall Quantity, the Joint becomes ſtiff; and when with Difficulty it is moved, a crackling Noiſe is heard, as People advanced in Years frequently experience (*a*).—If the Mucilage and Lymph are depoſited in too great Quantity, and the abſorbent Veſſels do not perform their Office ſufficiently, they may occaſion a Dropſy of the Joints (*b*).—From this ſame Cauſe alſo the Ligaments are often ſo much relaxed, as to make the Conjunction of the Bones very weak: Thence ariſe the Luxations from an internal Cauſe, which are eaſily reduced, but difficultly cured (*c*).——Frequently, when ſuch a ſuperfluous Quantity of this Liquor is pent up, it becomes very acrid, and occaſions a great Train of bad Symptoms; ſuch as Swelling and Pain of the Joints, long ſinuous Ulcers and *Fiſtulæ*, rotten Bones, Immobility of the Joints, *Marcor* and *Atrophia* of the whole Body, hectic Fevers, *&c.* (*d*). From a Depravity in the Blood or Diſeaſes in the Organs that furniſh the *Synovia* of the Joints, it may be greatly changed from its natural State, it may be purulent after Inflammation, mucous in the white Swellings, gelatinous in the Rheumatiſm, chalky from the Gout, *&c.* hence a great Variety of Diſorders in the Joints (*e*).

[†] Μυζα, Mucus, Axungia.

(a) *Parè*, Chirurgie. livre 15. chap. 18. & livre 16. chap. 5.

The

(*a*) *Galen.* de uſu Part. lib. 12. cap. 2. —— *Fabric. ab Aquapend.* de Articul. part. utilitat. pars 3. —— *Bartholin.* Hiſt. medic. Cent. 3. Hiſt. 11.

(*b*) *Hildan.* de Ichore & Meliceria acri Celſi.

(*c*) *Hippocrat.* de locis in homine, §. 14. & de Articul.

(*d*) *Hildan.* de Ichore & Meliceria acri Celſi.

(*e*) See Reimar Diſſert. de fungo Articular.

THE ANATOMY OF THE HUMAN BONES.

PART II.

Of the SKELETON.

THOUGH any dry Subſtance may be called *Skeleton*, yet, among Anatomiſts, this Word is univerſally underſtood to ſignify the Bones of Animals connected together, after the Teguments, Muſcles, Bowels, Glands, Nerves, and Veſſels are taken away *.

A *Skeleton* is ſaid to be a *natural* one, when the Bones are kept together by their own Ligaments; and it is called *artificial*, when the Bones are joined with Wire, or any other Subſtance which is not Part of the Creature to which they belonged. Small Subjects, and ſuch whoſe Bones are not fully oſſified, are commonly prepared the firſt Way; because, were all their Parts divided, the niceſt Artiſt could not rejoin them, by reaſon of their Smallneſs, and of the Separation of their unoſſified Parts; whereas the Bones of large adult Animals are ſooneſt and moſt conveniently cleaned when ſingle, and are eaſily reſtored to, and kept in their natural Situation.—Sometimes the Skeleton of the ſame Animal is prepared in both theſe Ways; that is, the ſmaller Bones are kept together by their natural Ligaments, and the larger ones are connected by Wires, or ſome ſuch Subſtances.

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* Cadaveris crates.

Before we proceed to the Diviſion and particular Deſcription of the Skeleton, it is worth while to remark, that when the Bones are put into their natural Situation, ſcarce any one of them is placed in a perpendicular Bearing to another; though the Fabrick compoſed of them is ſo contrived, that, in an erect Poſture, a perpendicular Line, from their common Center of Gravity, falls in the Middle of their common Baſe *(a)*. On this Account, we can ſupport ourſelves as firmly, as if the Axis of all the Bones had been a ſtreight Line perpendicular to the Horizon; and we have much greater Quickneſs, Eaſe and Strength in ſeveral of the moſt neceſſary Motions we perform. It is true indeed, that where-ever the Bones, on which any Part of our Body is ſuſtained, decline from a ſtreight Line, the Force required in the Muſcles to counteract the Gravity of that Part, is greater than otherwiſe it needed to have been: But then this is effectually provided for in ſuch Places, by the Number and Strength of the Muſcles. As long therefore as we remain in the ſame Poſture, a conſiderable Number of Muſcles muſt be in a conſtant State of Contraction; which we know, both from Reaſon and Experience, muſt ſoon create an uneaſy Senſation. This we call, being weary of one Poſture: An Inconvenience that we ſhould not have had in ſtanding erect, if the Bearing of all the Bones to each other had been perpendicular; but is more than compenſated by the Advantages above mentioned.

(a) *Cowper*. Anat. of human Bodies, Explic. of Tab. 87 88.

The human Skeleton is generally divided into the HEAD, the TRUNK, the SUPERIOR and the INFERIOR EXTREMITIES.

Of the HEAD.

BY the *HEAD* is meant all that ſpheroidal Part which is placed above the firſt Bone of the Neck. It therefore comprehends the *Cranium* and Bones of the *Face*.

The *Cranium* *, Helmet, or Brain-caſe, conſiſts of ſeveral Pieces; which form a vaulted Cavity, for lodging and defending the Brain, *Cerebellum*, with their Membranes, Veſſels, and Nerves.

The Cavity of the *Cranium* is proportioned to its Contents. Hence ſuch a Variety of its Size is obſerved in different Subjects; and hence t is neither ſo broad nor ſo deep at its Forepart,

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* Κογχος, κύτος, κάδεια, σκαφίον, calva, cavaria, cerebri alea, theca & olla capitis, teſta capitis, ſcutella capitis.

part, in which the anterior Lobes of the Brain are lodged, as it is behind, where the large poſterior Lobes of the Brain, and the whole *Cerebellum*, are contained.

The roundiſh Figure of the Scull, which makes it more capacious, and better able to defend its Contents from external Injuries, is chiefly owing to the equal Preſſure of theſe contained Parts as they grow and increaſe before it is entirely oſſified.—It is to be obſerved, however, that in Adults the Sides of the *Cranium* are depreſſed below a ſpherical Surface by the ſtrong temporal Muſcles, whoſe Action hinders here the uniform Protruſion of the Bones, which is more equally performed in other Parts, where no ſuch large Muſcles are. In Children, whoſe Muſcles have not acted much, and conſequently have not had great Effects on the Bones, this Depreſſion is not ſo remarkable; and therefore their Heads are rounder than in Adults. Theſe natural Cauſes, differently diſpoſed in different People, produce a great Variety in the Shapes of Sculls, which is ſtill increaſed by the different Management of the Heads of Children when very young: So that one may know a *Turk*'s Scull by its globular Figure, a *German*'s by its Breadth and Flatneſs of the *Occiput*, *Dutch* and *Engliſh* by their oblong Shapes, *&c.* (*a*). Two Advantages are reaped from this Flatneſs of the Sides of the *Cranium*, *viz.* the Enlargement of our Sphere of Viſion, and more advantageous Situation of our

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(*a*) *Veſal.* Lib. 1. cap. 5.

our Ears, for receiving a greater Quantity of Sound, and for being leſs expoſed to Injuries.

The external Surface of the upper Part of the *Cranium* is very ſmooth, and equal, being only covered with the *Perioſteum*, (common to all the Bones, but, in the Scull, diſtinguiſhed by the Name of *Pericranium*), the thin *frontal* and *occipital* Muſcles, their tendinous *Aponeuroſis*, and with the common Tegument of the Body; while the external Surface of its lower Part has numerous Riſings, Depreſſions and Holes, which afford convenient Origin and Inſertion to the Muſcles that are connected to it, and allow ſafe Paſſage for the Veſſels and Nerves that run through and near it.

The internal Surface of the upper Part of the Scull is commonly ſmooth, except where the Veſſels of the *Dura Mater* have made Furrows n it, while the Bones were ſoft.——Surgeons hould be cautious when they trepan here, leſt, n ſawing or raiſing the Bone where ſuch Furrows are, they wound the Veſſels of the *Dura Ma-er*.——In the upper Part of the internal Surface of ſeveral Sculls, there are likewiſe Pits of dif-erent Magnitudes and Figures, which ſeem to e formed by ſome Parts of the Brain being more luxuriant and prominent than others. Where theſe Pits are, the Scull is ſo much thin-er than any where elſe, that it is often render-d diaphanous, the two Tables being cloſely ompacted without a *Diploe;* the Want of which s ſupplied by Veſſels going from the *Dura Ma-er* into a great many ſmall Holes obſervable in he Pits. Theſe Veſſels are larger, and much ore conſpicuous than any others that are ſent from the *Dura Mater* to the Scull; as evidently appears from the Drops of Blood they pour out, when the Scull is raiſed from the *Dura Mater* in a recent Subject; and therefore they may furniſh a ſufficient Quantity of Liquors neceſſary to prevent the Brittleneſs of this thin Part.—The Knowledge of theſe Pits ſhould teach Surgeons, to ſaw cautiouſly and ſlowly through the external Table of the Scull, when they are performing the Operation of the *Trepan;* ſince, in a Patient whoſe *Cranium* has theſe Pits, the *Dura Mater* and Brain may be injured, before the Inſtrument has pierced near the ordinary Thickneſs of a Table of the Scull—The internal Baſe of the Scull is extremely unequal, for lodging the ſeveral Parts and *Appendices* of the Brain and *Cerebellum,* and allowing Paſſage and Defence to the Veſſels and Nerves that go into, or come out from theſe Parts.

The Bones of the *Cranium* are compoſed of two Tables, and intermediate *Cancelli,* commonly called their *Diploe* †. The external Table is thickeſt; the inner, from its Thinneſs and conſequent Brittleneſs, has got the Name of *Vitrea.* Whence we may ſee the Reaſon of thoſe miſchievous Conſequences, which ſo often attend a Collection of Matter in the *Diploe,* either from an external or internal Cauſe, before any Sign of ſuch a Collection appears in the Teguments that cover the Part of the Scull where it is lodged (*a*).

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† Meditullium, commiſſura.

(*a*) *Bonet.* Sepulchret. Anat. lib. 1. § 1. obſ. 96.—103.

The *Diploe* has much the ſame Texture and Uſes in the Scull, as the *Cancelli* have in other Bones.

The *Diploe* of ſeveral old Subjects is ſo obliterated, that ſcarce any Veſtige of it can be ſeen; neither is it obſervable in ſome of the hard craggy Bones at the Baſe of the Scull. Hence an uſeful Caution to Surgeons who truſt to the Bleeding, Want of Reſiſtance, and Change of Sound, as certain Marks in the Operation of the Trepan, for knowing when their Inſtrument has ſawed through the firſt Table, and reached the *Diploe* (*a*). In other People, the *Diploe* becomes of a monſtrous Thickneſs, while the Tables of the Scull are thinner than Paper.

The *Cranium* conſiſts of eight Bones, ſix of which are ſaid to be pròper, and the other two are reckoned common to it, and to the Face.—The ſix proper are the *Os frontis*, two *Oſſa parietalia*, two *Oſſa temporum*, and the *Os occipitis*.—The common are the *Os Ethmoides* and *Sphenoides*.

The *Os frontis* forms the whole Fore-part of the Vault; the two *Oſſa parietalia* form the upper and middle Part of it; the *Oſſa temporum* compoſe the lower Part of the Sides; the *Os occipitis* makes the whole hinder Part, and ſome of the Baſe; the *Os Ethmoides* is placed in the Fore-part of the Baſe, and the *Os Sphenoides* is in the Middle of it.

Theſe Bones are joined to each other by five *Sutures*; the Names of which are the *Coronal*, *Lambdoid*, *Sagittal*, and two *Squamous*.

(*a*) *Bartholin.* Anat. reform. Lib. IV. Cap. 4.

The *Coronal* [†] Suture is extended over the Head, from within an Inch or ſo of the external *Canthus* of one Eye, to the like Diſtance from the other; which being near the Place where the Antients wore their *Vittæ*, *Coronæ*, or Garlands, this Suture has hence got its Name.—Though the Indentations of this Suture are conſpicuous in its upper Part, yet an Inch or more of its End on each Side has none of them; for it is ſquamous and ſmooth there.

The *Lambdoidal* [‡] Suture begins ſome Way below, and farther back than the *Vertex* or Crown of the Head, whence its two Legs are ſtretched obliquely downwards, and to each Side, in Form of the *Greek* Letter Λ, and are now generally ſaid to extend themſelves to the *Baſe* of the Scull; but formerly Anatomiſts (*a*) reckoned the proper *Lambdoid* Suture to terminate at the *Squamous* Sutures, and what is extended at an Angle down from that on each Side, where the Indentations are leſs conſpicuous than in the upper Part of the Suture, they called *Additamentum ſuturæ Lambdoidis* [*].

This *Suture* is ſometimes very irregular, being made up of a great many ſmall Sutures, which ſurround ſo many little Bones that are generally larger and more conſpicuous on the external Surface of the Scull, than internally. Theſe Bones are generally called *Triquetra* or *Wormiana*; but ſome other Name ought to be

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[†] *Στεφαναῖα*, Arcualis, Puppis.

[‡] Laudæ, Proræ, Hypſyloides.

(*a*) *Veſal.* Anat. Lib. 1. cap. 6.

[*] *Lambdoides* harmonialis, *Lambdoides* inferior, occipitis corona.

e given them, for they are not always of a
riangular Figure; and older Anatomiſts (*a*) than
laus Wormius (*b*) have deſcribed them.—The
pecifick Virtue which theſe Bones were once
hought to have in the Cure of the Epilepſy
) is not now aſcribed to them; and Anatomiſts
enerally agree, that their Formation is owing
a greater Number of Points than ordinary
f Oſſification in the Skull, or to the ordinary
ones of the *Cranium* not extending their Oſ-
fication far enough or ſoon enough; in which
aſe, the unoſſified Interſtice between ſuch
ones, begins a ſeparate Oſſification in one or
ore Points; from which the Oſſification is ex-
ended to form as many diſtinct Bones as there
ere Points, that are indented into the large
rdinary Bones, and into each other.—Probably
hoſe Children who have a large Opening in
his Place at their Birth, will have the largeſt
ſa Triquetra.——To confirm this Account of
he Formation of theſe little Bones, we may
emark, that ſuch Bones are ſometimes ſeen in
ther Sutures, as well as in the *Lambdoid* (*d*),
d they are ſometimes in one Table of the
cull, and not in the other (*e*).

The

(*a*) *Euſtach.* Oſſium Examen.—*Bauhin.* Theat. Anat. lib.
cap. 5.——*Paaw* in Hippocrat. de Vulner. cap. p. 56.

(*b*) Muſæum, lib. 3. cap. 26.

(*c*) *Bauhin.* & *Paaw.* ibid.—*Bartholin.* Anat. reform. lib. 4.
p. 5.——*Hildan.* Epiſtol. 65.

(*d*) See Examples in *Veſal.* lib. 1. cap. 6. fig. 4.——*Paaw*
Hippocrat. de cap. Vuln. *Bartholin.* Hiſt. Anat. Cent. 1.
ſt. 51.—*Ruyſch.* Muſ. Anat.

(*e*) *Hunauld.* in Mem. de l'Acad. des Sciences, 1730.

The *Sagittal* Suture * is placed longitudinally in the Middle of the upper Part of the Scull, and commonly terminates at the Middle of the *Coronal*, and of the *Lambdoid* Sutures; between which it is ſaid to be placed, as an Arrow is between the String and Bow.—However this Suture is frequently continued through the Middle of the *Os frontis*, down to the Root of the Noſe; which, ſome (*a*) ſay, oftener happens in Women than Men; but others (*b*) alledge, that it is to be met with more frequently in Male Sculls, than in Female: Among the Sculls which I have ſeen thus divided, the Female are the moſt numerous.——Several (*c*) have delineated and deſcribed the *Sagittal* Suture, ſometimes dividing the *occipital* Bone as far down as the great Hole through which the *Medulla Spinalis* paſſes. This I never ſaw.

In ſome old Sculls that are in my Poſſeſſion, there is ſcarce a Veſtige of any of the three *Sutures* which I have now deſcribed. In other Heads, one or two of the Sutures only diſappear; but I never could diſcover any Reaſon for thinking them diſpoſed in ſuch different Manners in Sculls of different Shapes, as ſome Antients alledge they are (*d*).

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* *Ῥαβδοειδής, ὀβελαία, ἐπιζευγνῦσα*, Inſtar virgae, nervalis inſtar teli, inſtar veru, ſecundum capitis longitudinem prorepens, conjungens, columnalis, recta, acualis.

(*a*) *Riolan*. Comment. de Oſſib. cap. 8.

(*b*) *Veſal*. Lib. 1. cap. 6. et in Epitome.

(*c*) *Veſal*. Lib. 1. cap. 5. fig. 3, 4. et in Text. cap. 6.—*Paaw* in Celſ. de re medic. cap. 1.—*Laurent*. Hiſt. Anat. lib 2. cap. 16.

(*d*) *Hippocrat*. de Vulner. Capitis, § 1.—*Galen*. de Oſſib & de uſu Part. lib. 9. cap. 17.

The *Squamous Agglutinations*, or *Falſe Su-ures* †, are one on each Side, a little above the Ear, of a ſemicircular Figure, formed by the overlopping (like one Scale upon another) of he upper Part of the *temporal* Bones on the ower Part of the *Parietal*, where, in both Bones, there are a great many ſmall Riſings and Furrows, which are indented into each o-her; though theſe Inequalities do not appear till the Bones are ſeparated. In ſome Sculls indeed the Indentations here are as conſpicuous externally as in other Sutures (*a*); and what is commonly called the poſterior Part of this ſquamous Suture, always has the evident ſerrated Form; and therefore is reckoned by ſome (*b*), a diſtinct Suture, under the Name of *Additamentum poſterius ſuturæ ſquamoſæ.*——I have ſeen two ſquamous Sutures on the ſame Temple, with a ſemicircular Piece of Bone between hem.

We ought here to remark, that the true ſquamous Sort of Suture is not confined to the Conjunction of the temporal and parietal Bones, but is made Uſe of to join all the Edges of the Bones on which each temporal Muſcle is placed (*c*): For the two Parts of the ſphenoidal Suture which are continued from the anterior End of he common ſquamous Suture juſt now deſcribed, of which one runs perpendicularly downwards,

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† *Λεπιδοειδῆ, προσκολλήματα, κροταφίαι*, Temporales, Corticales, Mendoſæ, Harmoniales, Commiſſuræ in unguem.

(*a*) *Columb.* de re Anat. lib. 1. cap. 4.—*Dionis*, Anat. 3. Demonſt. des Os.

(*b*) *Albin.* de Oſſib. § 54.

(*c*) *Veſal.* Anat. lib. 1. cap. 6.—*Winſlow*, Mem. de l'Acad. des Sciences, 1720.

wards, and the other horizontally forwards, and alſo the lower Part of the coronal Suture already taken Notice of, may all be juſtly ſaid to pertain to the ſquamous *Suture*.—The Manner how I imagine this Sort of Suture is formed at theſe Places, is, That, by the Action of the ſtrong temporal Muſcles on one Side, and by the Preſſure of the Brain on the other, the Bones are made ſo thin, as to admit of no other Suture. The *ſquamous* Form is alſo more convenient here; becauſe ſuch thin Edges of Bones, when accurately applied one to another, have ſcarce any rough Surface, to obſtruct or hurt the Muſcle in its Contraction; which is ſtill further provided for, by the Manner of laying theſe Edges on each other; for, in viewing their Outſide, we ſee the temporal Bones covering the Sphenoidal and Parietal, and this laſt ſupporting the Sphenoidal, while both mount on the Frontal: From which Diſpoſition it is evident, that while the temporal Muſcle is contracting, which is the only Time it preſſes ſtrongly in its Motion on the Bones, its Fibres ſlide eaſily over the external Edges. Another Advantage ſtill in this is, that all this bony Part is made ſtronger by the Bones thus ſupporting each other.

The Bones of the Scull are joined to thoſe of the Face, by *Schyndeleſis* and *Sutures*.—The *Schyndeleſis* is in the Partition of the Noſe.—The Sutures ſaid to be common to the *Cranium* and Face are five, *viz.* the *Ethmoidal*, *Sphenoidal*, *Tranſverſe*, and two *Zygomatic*.—Parts however of theſe Sutures are at the Junction of only the Bones of the Scull.

The *Ethmoidal* and *Sphenoidal* Sutures ſur-
ound the Bones of theſe Names; and in ſome
laces help to make up other Sutures, particu-
rly the *Squamous* and *Tranſverſe*; and in o-
her Parts there is but one Suture common to
heſe two Bones.

The *Tranſverſe* Suture runs quite croſs the
ace, from the external *Canthus* of one Orbit
the ſame Place of the other, by ſinking from
e *Canthus* down the Out-ſide of the Orbit to
s Bottom; then mounting upon the Inſide, it
continued by the Root of the Noſe down the
ternal Part of the other Orbit, and up again
the other *Canthus*. It may be here remark-
d, that there are ſome Interruptions of this
uture in the Courſe I have deſcribed; for the
ones are not contiguous every where, but are
parated, to leave Holes and Apertures, to
mentioned hereafter.

The *Zygomatic* Sutures are one on each Side,
eing ſhort, and ſlanting from above obliquely
ownwards and backwards, to join a Proceſs of
e Cheek-bone to one of the *temporal* Bone,
hich advances towards the Face; ſo that the
o Proceſſes thus united, form a ſort of Bridge,
Jugum, under which the *temporal* Muſcle
aſſes; on which account the Proceſſes, and Su-
re joining them, have been called *Zygomatic*.

It muſt be obſerved, that the Indentations of
e *Sutures* do not appear on the Inſide of the
anium, by much ſo ſtrong as on the Out-ſide,
t the Bones ſeem almoſt joined in a ſtreight
ne: nay, in ſome Sculls, the internal Sur-
ce is found entire, while the Sutures are ma-
feſt without; which may poſſibly be owing to

the leſs Extent of the concave than of the co vex Surface of the *Cranium*, whereby the F bres of the internal Side would be ſtretche farther out at the Edges of the Bones, than th exterior ones, if they were not reſiſted. Th Reſiſtances are the Fibres of the oppoſite Bone the Parts within the Scull, and the *Diploe*; o which the laſt being the weakeſt, the moſt ad vanced Fibres or *Serræ* run into it, and leav the contiguous Edges equal, and more ready t unite: Whereas the *Serræ* of the external Tabl have ſpace enough for their Admiſſion betwee the Fibres of the oppoſite Bone; and therefor remain of the indented Form, and are leſs li able to the Concretion, whereby the Suture are obliterated (*a*).——By this Mechaniſm there is no Riſk of the ſharp Points of the Bone growing inwards, ſince the external *Serræ* o each of the conjoined Bones reſt upon the in ternal ſmooth edg'd Table of the other; an external Forces applied to theſe Parts ar ſtrongly reſiſted, becauſe the Sutures canno yield, unleſs the ſerrated Edges of the on Bone, and the plain internal Plate of the othe are broken (*b*).

The Advantages of the Sutures of the *Crani um* are theſe: 1. That this *Capſula* is mor eaſily formed and extended into a ſpherical Fi gure, than if it had been one continued Bone 2. That the Bones which are at ſome Diſtanc from each other at Birth, might then yiel and allow to the Head a Change of Shape, ac commodated to the Paſſage it is engaged in

Whence

(*a*) *Hunauld*, Memoires de l'Acad. des Sciences, 1730.

(*b*) *Winſlow*, Memoires de l'Acad. des Sciences, 1720.

Whence, in hard labour of Child-bed, the Bones of the *Cranium*, inſtead of being only brought into Contact, are ſometimes made to nount one upon the other. 3. It is alledged, hat, thro' the Sutures, there is a Tranſpiration of Steams from the Brain, which was the old Doctrine; or ſome Communication of the Veſels without, and of thoſe within the Scull, arger here than in any other Part of the *Cranium*, according to ſome Moderns; and thereore *Cucuphæ*, *Fomentations*, *Cataplaſms*, *cephaic Plaiſters*, *Bliſters* are applied, and *Iſſues* are roded, or cut in the Head, at thoſe Places vhere the Sutures are longeſt in forming, and vhere the Connexion of the Bones is aftervards looſeſt, for the Cure of a *Phrenitis*, *Maia*, *inveterate Head-ach*, *Epilepſy*, *Apoplexy*, and ther Diſeaſes of the Head. The Favourers of he Doctrine of Tranſpiration, or Communiation of Veſſels at the Sutures, endeavour to upport it by Obſervations of Perſons ſubject to Iead-achs which cauſed Death, from the Sutures being too cloſely united (*a*). 4. That he *Dura Mater* may be more firmly ſuſpended y its Proceſſes, which inſinuate themſelves into his Conjunction of the Bones; for doing this qually, and where the greateſt Neceſſity of dheſion is, the Sutures are diſpoſed at nearly qual Diſtances, and the large *Reſervoires* of ood, the *Sinuſes*, are under or near them. That Fractures might be prevented from

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(*a*) *Columb.* de re Anat. lib. 1. cap. 5. —— *Verduc.* noue Oſteologie, chap. 14. —— *Dionis*, Anat. 3. Demonſtr. Os.

reaching ſo far as they would in a continued bony Subſtance. 6. That the Connexion at the Sutures being capable of yielding, the Bones might be allowed to ſeparate; which has given great Relief to Patients from the violent ſymptoms which they had before this Separation happened (*a*). And it ſeems reaſonable to believe, that the opening of the Sutures was of great Benefit to ſeveral others who were rather judged to have been hurt by it (*b*). For we muſt think, that the Conſequences of ſuch an Force acting upon the Brain, as was capable of thruſting the Bones aſunder, muſt have been fatal, unleſs it had been thus yielded to.

Having gone through the general Structure of the *Cranium*, I now proceed to examine each Bone of which that Brain-caſe conſiſts, in the Order in which I firſt named them.

The *OS FRONTIS* † has its Name from its being the only Bone of that Part of the Face we call the *Forehead*, though it reaches a good deal further. It has ſome reſemblance in Shape to the Shell of the *Concha bivalvis*, commonly called the *Cockle*; for the greateſt Part of it is convex externally, and concave internally, with a ſerrated circular Edge; while the ſmaller

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(*a*) Ephemerid. Germanic. Dec. 1. Ann. 4. & 5. Obſerv. 33.

(*b*) Ephemerid. Germ. Dec. 2. Ann. 9. Obſ. 230. Ibi Cent. 10. Obſ. 31.—*Vander Linden* Medicin. Phyſ. cap. art. 4. §. 16.—*Hildan.* Obſerv. Cent. 1. Obſ. 1. Cent. Obſ. 7.—Bauhin. Theat. Anat. Lib. 3. cap. 6.—*Pechli* Obſerv. Lib. 2. Obſerv. 39.

† Μετώπυ, Βρέγμα, Coronale, Inverecundum, Puppis, ſenſus *communis*, Sincipitis.

ſmaller Part has Proceſſes and Depreſſions, which make it of an irregular Figure.

The external Surface of the *Os frontis* is ſmooth at its upper convex Part; but ſeveral Proceſſes and Cavities are obſervable below: For, at each Angle of each Orbit, the Bone jutts out, to form four Proceſſes, two internal, and as many external; which, from this Situation, may well enough be named *angular*. Between he internal and external angular Proceſſes of each Side, an arched Ridge is extended, on which the Eye-brows are placed.——Very little above the internal End of each of theſe *ſuperciliary* Ridges, a Protuberance may be remarked, n moſt Sculls, where there are large Cavities, called *Sinuſes*, within the Bone; of which hereafter. —Betwixt the internal angular Proceſſes, a ſmall Proceſs riſes, which forms ſome Share of the Noſe, and thence is named *Naſal*.——Some obſerve a protuberant Part on the Edge of the Bone behind each external angular Proceſs, which they call *temporal* Proceſſes; but theſe are inconſiderable.—From the under Part of he ſuperciliary Ridges, the frontal Bone runs a great Way backwards; which Parts may juſtly nough be called *orbitar* Proceſſes. Theſe, ontrary to the reſt of this Bone, are concave xternally, for receiving the Globes of the Eyes, with their Muſcles, Fat, *&c.*

In each of the *orbitar* Proceſſes, behind the Middle of the ſuperciliary Ridges, a conſiderble Sinuoſity is obſerved, where the *Glandula nnominata Galeni* or *lachrymalis* is lodged.—Behind each internal angular Proceſs, a ſmall Pit ay be remarked, where the cartilaginous Pully of the *Muſculus obliquus major* of the Eye is fixed. —— Betwixt the two orbitar Proceſſes, there is a large Diſcontinuation of the Bone, into which the cribriform Part of the *Os ethmoides* is incaſed.—The frontal Bone frequently has little Caverns formed in it here where it is joined to the ethmoid Bone——Behind each external angular Proceſs, the Surface of the frontal Bone is conſiderably depreſſed where part of the *temporal* Muſcle is placed.

The *Foramina*, or Holes, obſervable on the external Surface of the frontal Bone, are three in each Side. —— One in each ſuperciliary Ridge, a little removed from its Middle towards the Noſe; through which a Twig of the *Ophthalmic* Branch of the fifth Pair of Nerves paſſes out of the Orbit, with a ſmall Artery from the internal Carotid, to be diſtributed to the Teguments and Muſcles of the Forehead.—— Theſe Veſſels in ſome Sculls make Furrows in the *Os frontis*, eſpecially in the Bones of Children, as has alſo been obſerved of another conſiderable Veſſel of this Bone near its Middle (*a*): and therefore we ought to beware of tranſverſe Inciſions on either Side of the *Os frontis*, which might either open theſe Veſſels, while they are yet in Part within the Bone; for, in ſuch a Caſe, it is difficult to ſtop an Hæmorrhagy, becauſe the Adheſion of a Part of the Artery to the Bone, hinders its Contraction, and conſequently Styptics can have little Effect; the Sides of the Furrow keep off compreſſing Subſtances from the Artery; and we would wiſh to ſhun Cauteries

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(*a*) *Ruyſch.* Muſ. Anat. Theca D. Repoſit. 4. No. 3.

Cauteries or Eſcharotics, becauſe they make the Bone carious; or might wound the Nerves, ſo s to produce violent Symptoms.—But, to re-urn to the *ſuperciliary Foramina*, we muſt re-nark, that often, inſtead of a Hole, a Notch nly is to be ſeen: Nay, in ſome Sculls, ſcarce Veſtige even of this is left; in others, both Hole and Notch are obſervable, when the Nerve nd Artery run ſeparately. Frequently a Hole s found on one Side, and a Notch on the other; t other Times we ſee two Holes; or there is a ommon Hole without, and two diſtinct Entries nternally. The Reaſon of this Variety of a Hole, Notch, Depreſſion, or Smoothneſs in the uperciliary Ridge, is the different Length and Tenſion of the Nerves and Veſſels; the ſhorter hey are, the more they are ſunk into the Bone s it grows.—Near the Middle of the Inſide of ach Orbit, hard by, or in the *tranſverſe Su-ure*, there is a ſmall Hole for the Paſſage of he naſal Twig of the firſt Branch of the fifth Pair of Nerves, and of a Branch of the oph-halmic Artery. This Hole is ſometimes entire-y formed in the *Os frontis*; in other Sculls, the ides of it are compoſed of this laſt Bone, and f the *Os planum*. It is commonly known by he Name of *Orbitarium internum*, though *ante-ius* ſhould be added, becauſe of the next, which commonly omitted.—This, which may be alled *Orbitarium internum poſterius*, is ſuch ano-her as the former; only ſmaller, and about an nch deeper in the Orbit: Through it a ſmall ranch of the ocular Artery paſſes to the Noſe.—Beſides theſe ſix, there are a great Num-er of ſmall Holes obſervable on the outer Surface of this Bone, particularly in the two Protuberances above the Eye-brows. Moſt of theſe penetrate no further than the *Sinuſes*, or than the *Diploe*, if the *Sinuſes* are wanting; though ſometimes I have ſeen this Bone ſo perforated by a vaſt Number of theſe ſmall Holes, that, placed between the Eye and a clear Light, it appeared like a Sieve.—In the Orbit of the Generality of *Skeletons*, we may obſerve one, two, or more Holes, which allow a Paſſage to a Hog's Briſtle through the Scull. The Place, Size and Number of theſe, are however uncertain: They generally ſerve for the Tranſmiſſion of ſmall Arteries or Nerves.

The internal Surface of the *Os frontis* is concave, except at the orbitar Proceſſes, which are convex, to ſupport the anterior Lobes of the Brain. This Surface is not ſo ſmooth as the external; for the larger Branches of the Arteries of the *Dura Mater* make ſome Furrows in its Sides and back Parts. The Sinuoſities from the luxuriant Riſings of the Brain, mentioned when deſcribing the general Structure of the *Cranium*, are often very obſervable on its upper Part; and its lower and fore Parts are marked with the Contorſions of the anterior Lobes of the Brain.——Through the Middle of this internal Surface, where always in Children, and ſometimes in old People, the Bone is divided, either a Ridge ſtands out, to which the upper Edge of the *Falx* is faſtened, or a Furrow runs, in which the upper Side of the ſuperior longitudinal *Sinus* is lodged; on both theſe Accounts chirurgical Authors juſtly diſcharge the Application of the Trepan here. The Reaſon of this

Difference

ifference in Sculls, is alledged by ſome Au- hors to be this, That in thin Sculls the Ridge trengthens the Bones, and in thick ones there no Occaſion for it. To this Way of account- ng for this Phænomenon, it may juſtly be ob- ected, that generally very thick Sculls have a rge Spine here, and frequently thin ones have nly a Furrow. Perhaps this Variety may be wing to the different Times of a compleat Oſ- fication of thoſe Parts in different Subjects : or if the two Sides of this Bone meet before ney arrive at their utmoſt Extent of Growth, ney unite very firmly, and all their Fibres en- eavour to ſtretch themſelves out where the aſt Reſiſtance is, that is, between the Hemi- heres of the Brain. To ſupport this Reaſon- ng, we may remark, that thoſe Adults, whoſe rontal Bone is divided by the ſagittal Suture, ever have a Ridge in this Place.

Immediately at the Root of this Ridge or urrow there is a ſmall Hole, which ſometimes ierces through the firſt Table, and, in other culls, opens into the ſuperior *Sinus* of the *Eth- oid* Bone within the Noſe. In it a little Pro- eſs of the *Falx* is lodged, and a ſmall Artery, nd ſometimes a Vein, runs (*a*); and the ſupe- or longitudinal *Sinus* begins here.—This Hole, owever, is often not entirely proper to the *Os rontis* ; for in ſeveral Sculls, the lower Part of is formed in the upper Part of the Baſe of the *riſta Galli*, which is a Proceſs of the *Os Eth- oides* (*b*).

The

(*a*) *Morgagn.* Adverſar. 6. Animad. 31.

(*b*) *Ingraſſ.* Comment. in *Galen.* de Oſſib. cap. 1. Com- ent. 8.

The *Os frontis* is compoſed of two Tables, and an intermediate *Diploe*, as the other Bones of the *Cranium* are, and, in a middle Degree of Thickneſs between the *Os occipitis* and *parietalia*, is pretty equally denſe all through, except at the orbitar Proceſſes; where, by the Action of the Eye on one Side, and Preſſure of the Lobes of the Brain on the other, it is made extremely thin and diaphanous, and the *Meditullium* is entirely obliterated. Since in this Place there is ſo weak a Defence for the Brain, the Reaſon appears why Fencers eſteem a Puſh in the Eye mortal (*a*).

The *Diploe* is alſo exhauſted in that Part above the Eye-brows, where the two Tables of the Bone ſeparate, by the external being protruded outwards, to form two large Cavities, called *Sinus frontales*.—Theſe are divided by a middle perpendicular bony Partition.——Their Capacities in the ſame Subject are ſeldom equal; in ſome the Right, in others the Left is largeſt.—And in different Bones their Size is as inconſtant; nay, I have examined ſome, where they were entirely wanting; which oftener happens in ſuch as have a flat Fore-head, and whoſe ſagittal Suture is continued down to the Noſe, than in others (*b*).—In ſome Sculls, beſides the large perpendicular *Septum*, there are ſeveral bony Pillars, or ſhort Partitions, found in each *Sinus*; in others theſe are wanting.——For the moſt Part the *Septum* is entire; at other Times it

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(*a*) *Ruyſch.* Obſerv. Anat. Chir. Obſerv. 54.—*Diemerbroeck.* Anat. lib. 3. cap. 10.—*Bonet.* Sepulch. Anat. lib. 4. § 3. Obſerv. 17.

(*b*) *Fallop.* Expoſit. de Oſſibus, cap. 13.

is diſcontinued, and the two *Sinuſes* commuicate—When the *Sinuſes* are ſeen in ſuch Sculls s have the frontal Bone divided by the ſagittal uture, the Partition dividing theſe Cavities, is vidently compoſed of two Plates, which eaſily eparate.——Each *Sinus* commonly opens by a oundiſh ſmall Hole, at the inner and lower Part f the internal angular Proceſſes, into a *Sinus* ormed in the Noſe, at the upper and back Part f the *Os unguis;* near to which there are alſo ome other ſmall *Sinuſes* of this Bone (*a*), the reater Part of which open ſeparately nearer he *Septum narium*, and often they terminate in he ſame common Canal with the large ones.

In a natural and ſound State, theſe Cavities e of conſiderable Advantage; for the Organ f Smelling being thus enlarged, the *Effluvia* f odorous Bodies more difficultly eſcape it; nd their Impreſſions being more numerous, are herefore ſtronger, and affect the Organ more.—heſe and the other Cavities which open into he Noſe, increaſe the Sound of our Voice, and ender it more melodious, by ſerving as ſo many aults to reſound the Notes. Hence People laouring under a *Coryza*, or Stoppage of the oſe from any other Cauſe, when they are by he Vulgar, though falſely, ſaid to ſpeak through heir Noſe, have ſuch a diſagreeable harſh oice.—The Liquor ſeparated in the Membrane f theſe Sinuſes, drills down upon the Memrane of the Noſe to keep it moiſt.

From the Deſcription of theſe *Sinuſes*, it is vident, how uſeleſs, nay, how pernicious it muſt

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(*a*) *Cowper* in *Drake*'s Anthropolog. Book 3. Chap. 10.

muſt be, to apply a Trepan on this Part of the Scull; for this Inſtrument, inſtead of piercing into the Cavity of the *Cranium*, would reach no further than the *Sinuſes*; or, if the inner Table was perforated, any extravaſated Blood that happened to be within the Scull, would not be diſcharged outwardly, but would fall into the *Sinuſes*, there to ſtagnate, corrupt, and ſtimulate the ſenſible Membranes; from which alſo there would be ſuch a conſtant Flow of glairy Mucus, as would retard, if not hinder a Cure, and would make the Sore degenerate into an incurable *Fiſtula*. Beſides, as it would be almoſt impoſſible in this Caſe to prevent the Air, paſſing through the Noſe, from having conſtant Acceſs to the *Dura Mater*, or Brain; ſuch a Corruption would be brought on theſe Parts, as would be attended with great Danger. Further, in Reſpiration, the Air ruſhing violently into theſe Cavities of the *Os frontis*, and paſſing through the external Orifice, whenever it was not well covered and defended, would not only prevent the cloſing up of the external Orifice, but might otherwiſe bring on bad Conſequences (*a*).——The Membrane lining theſe *Sinuſes* is ſo ſenſible, that Inflammations of it muſt create violent Torture (*b*); and Worms, or other Inſects, crawling there, muſt give great Uneaſineſs (*c*).

The

(*a*) *Paaw*, de Oſſibus Parſ. 1. cap. 7.——*Palfyne* Anatom. Chir. Traite 4. chap. 15. Nouvelle Oſteologie, Partie 2. chap. 3.

(*b*) *Fernel.* Partholog. lib. 5. cap. 7. — *Seltzman* Decur. Obſerv. 10.

(*c*) *Fernel.* Partholog. lib. 5. cap. 7.—*Bartholin.* Epiſtol. Medic. Cent. 2. Epiſt. 74.——Hiſt. de l'Acad. des Sciences, 1708 & 1733.

The upper circular Part of the *Os frontis*, is
ined to the *Oſſa parietalia*, from one Temple
the other, by the coronal Suture. From the
ermination of the coronal Suture to the ex-
rnal angular Proceſſes, this Bone is connected
the *Sphenoid* by the *ſphenoidal* Suture. At
e external *Canthi* of the Eyes, its angular Pro-
eſſes are joined by the tranſverſe Suture to the
ſa malarum, to which it adheres one Third
own the Outſide of the Orbits; whence to the
ottom of theſe Cavities, and a little up on
eir internal Sides, theſe Orbitar Proceſſes are
onnected to the *ſphenoidal* Bone by that ſame
uture.—In ſome few Sculls, however, a Diſ-
ontinuation of theſe two Bones appears at the
pper Part of the long Slit, near the Bottom
the Orbit.—On the Inſide of each Orbit,
e orbitar Proceſs is indented between the *cri-
iform* Part of the *ethmoid* Bone, and the *Os
anum* and *unguis*.—The tranſverſe Suture af-
rwards joins the frontal Bone to the ſuperior
aſal Proceſſes of the *Oſſa maxillaria ſuperiora*,
d to the naſal Bones. And, *laſtly*, its naſal
roceſs is connected to the naſal *Lamella* of the
hmoid Bone.

The *frontal* Bone ſerves to defend and ſup-
ort the anterior Lobes of the Brain. It forms
conſiderable Part of the Cavities that contain
e Globes of the Eyes, helps to make up the
eptum narium, Organ of Smelling, &c. From
e Deſcription of the ſeveral Parts, the other
ſes of this Bone are evident.

In a ripe Child, the frontal Bone is divided
rough the Middle; the ſuperciliary Holes are
ot formed; often a ſmall round Piece of each
orbitar

orbitar Proceſs, behind the ſuperciliary Ridge, is not oſſified, and there is no *Sinus* to be ſeen within its Subſtance.

Each of the two *OSSA PARIETALIA**, or Bones ſerving as Walls to the *Encephalon*, is an irregular Square; its upper and fore Sides being longer than the one behind or below. The inferior Side is a concave Arch; the middle Part receiving the upper round Part of the temporal Bone.—The Angle formed by this upper Side, and the fore One, is ſo extended, as to have the Appearance of a Proceſs.

The external Surface of each *Os parietale* is convex. Upon it, ſomewhat below the middle Height of the Bone, there is a tranſverſe arched Ridge, of a whiter Colour generally than any other Part of the Bone; from which, in Bones that have ſtrong Prints of Muſcles, we ſee a great many converging Furrows, like ſo many *Radii* drawn from a Circumference towards a Center. From this Ridge of each Bone the temporal Muſcle riſes; and, by the Preſſure of its Fibres, occaſions the Furrows juſt now mentioned.——Below theſe, we obſerve, near the ſemcircular Edges, a great many Riſings and Depreſſions, which are joined to like Inequalities on the Inſide of the temporal Bone, to form the ſquamous Suture. The temporal Bone may therefore ſerve here as a Buttreſs, to prevent the lower Side of the Parietal from ſtarting outwards when its upper Part is preſſed or ſtruck (*a*).

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* Κορυφῆς, Paria, ſyncipitis, verticis, arcualia, nervalia, cogitationis, rationis, bregmatis, madefactionis.

(*a*) *Hunauld* in Mem. de l'Acad. des Sciences, 1730.

Near the upper Sides of theſe Bones, towards
he hind Part, is a ſmall Hole in each, through
which a Vein paſſes from the Teguments of the
Head to the longitudinal *Sinus*. Sometimes I
ave ſeen a Branch of the temporal Artery
aſs through this Hole, to be diſtributed to the
pper Part of the *Falx*, and to the *Dura Ma-*
er at its Sides, where it had frequent Anaſto-
noſes, with the Branches of the Arteries de-
ived from the external Carotids, which com-
monly have the Name of the Arteries of the
Dura Mater, and with the Branches of the in-
ernal Carotids which ſerve the *Falx*.—In ſeve-
al Sculls, one of the *Oſſa parietalia* has not this
Hole; in others, there are two in one Bone;
nd in ſome not one in either. Moſt frequent-
y this Hole is thro' both Tables; at other
Times the external Table is only perforated.—
The Knowledge of the Courſe of theſe Veſſels,
nay be of Uſe to Surgeons, when they make
ny Inciſion near this Part of the Head; leſt,
f the Veſſels are raſhly cut near the Hole, they
hrink within the Subſtance of the Bone, and
o cauſe an obſtinate Hæmorrhagy, which nei-
her Ligatures nor Medicines can ſtop.

On the inner concave Surface of the parie-
al Bones, we ſee a great many deep Furrows,
iſpoſed ſomewhat like the Branches of Trees:
The Furrows are largeſt and deepeſt at the
ower Edge of each *Os parietale*, eſpecially near
s anterior Angle, where ſometimes a full Ca
al is formed: They afterwards divide into
mall Furrows, in their Progreſs upwards.——
n ſome Sculls a large Furrow begins at the
Hole near the upper Edge, and divides into

Branches,

Branches, which join with thoſe which come upwards, ſhewing the Communications of the upper and lower Arteries of the *Dura Mater*.—In theſe Furrows we frequently ſee Paſſages into the *Diploe;* and ſometimes I have obſerved Canals going off, which allowed a ſmall Probe to paſs ſome Inches into the bony Subſtance. Some *(a)* tell us, that they have obſerved theſe Canals piercing the Bone towards the *Occiput*.—On the Inſide of the upper Edge of the *Oſſa parietalia*, there is a large Sinuoſity, frequently larger in the Bone of one Side than of the other, where the upper Part of the *Falx* is faſtened, and the ſuperior longitudinal *Sinus* is lodged.—Generally Part of the lateral *Sinuſes* makes a Depreſſion near the Angle, formed by the lower and poſterior Sides of theſe Bones; and the Pits made by the prominent Parts of the Brain are to be ſeen in no Part of the Scull more frequent, or more conſiderable, than in the internal Surface of the parietal Bones.

The *Oſſa parietalia* are amongſt the thinneſt Bones of the *Cranium;* but enjoy the general Structure of two Tables and *Diploe* the completeſt, and are the moſt equal and ſmooth.

Theſe Bones are joined at their Fore-ſide to the *Os frontis* by the coronal Suture; at their long inferior Angles, to the *ſphenoid* Bone, by Part of the Suture of this Name; at their lower Edge, to the *Oſſa temporum*, by the ſquamous Suture and its poſterior *Additamentum;* behind, to the *Os occipitis*, or *Oſſa triquetra*, by the

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(*a*) *Cowper*, Anatom. Explic. of XC. Tab. Fig. 2.

the lambdoid Suture; and above, to one another, by the ſagittal Suture.

They have no particular Uſes beſides thoſe mentioned in the Deſcription of their ſeveral Parts, except what are included in the Account of the general Structure of the *Cranium*.

In a Child born at the full Time, none of the Sides of this Bone are completed; and there never is a Hole in the oſſified Part of it near to the ſagittal Suture.

The large unoſſified ligamentous Part of the *Cranium* obſervable between the parietal Bones, and the Middle of the divided *Os frontis* of new-born Children, called by the Vulgar *the Open of the Head*, was imagined by the Antients to ſerve for the Evacuation of the ſuperfluous Moiſture of the Brain; and therefore they named it *Bregma* *, or the Fountain; ſometimes adding the Epithet *pulſatilis*, or beating, on account of the Pulſation of the Brain, felt through this flexible Ligamento-cartilaginous Subſtance. Hence very frequently the parietal Bones are called *Oſſa Bregmatis*.

The upper middle Part of the Head of a Child, in a natural Birth, being what preſents itſelf firſt at the *Os uteri* (*a*), an Accoucheur may reach the *Bregma* with his Finger, when the *Os uteri* is a little opened. If the *Bregma* is ſtretched, and the Pulſation of the Brain is felt through it, the Child is certainly alive: But if it is ſhrivelled and flaccid, without any obſervable Pulſation in it, there is Reaſon to

judge

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* Palpitans vertex, foliolum, folium, triangularis lacuna.

(*a*) *Burton*'s Midwifery, § 51.—*Smellie*'s Midwifery, Book 1. Chap. 1. § 5.

judge the Child to be very weak, or dead. Thoſe who practiſe Midwifery ſhould therefore examine the State of the *Bregma* accurately.

All the *Bregma* is generally oſſified before ſeven Years of Age. Several Authors *(a)* ſay, they have obſerved it unoſſified in Adults; and Phyſicians, who order the Application of Medicines at the Meeting of the coronal and ſagittal Sutures, ſeem yet to think that a Derivation of noxious Humours from the *Encephalon* is more eaſily procured at this Part than any other of the Scull; and that Medicines have a greater Effect here, than elſewhere, in the internal Diſorders of the Head.

OSSA TEMPORUM ||, ſo named, ſay Authors, from the Hair's firſt becoming gray on the Temples, and thus diſcovering Peoples Ages, are each of them equal and ſmooth above, with a very thin ſemicircular Edge; which, from the Manner of its Connexion with the neighbouring Bones, is diſtinguiſhed by the Name of *Os ſquamoſum*.—Behind this, the upper Part of the temporal Bone is thicker, and more unequal, and is ſometimes deſcribed as a diſtinct Part, under the Name of *Pars mammillaris (b)*.—Towards the Baſe of the Scull, the temporal Bone appears very irregular and unequal; and this Part, inſtead of being broad, and placed perpendicularly, as the others are, is contracted into an oblong very hard Subſtance, extended

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(a) *Bartholin.* Anat. Reform. lib. 4. cap. 6.——*Diemerbroeck*, Anat. lib. 9. cap. 6.——*Kerkring.* Oſteogen. cap. 2.

|| Κρόταφῶν, κορσῶν, κοῤῥῶν, λεπιδοειδῆ, πολυειδῆ, λιθοειδῆ, temporalia, lapidoſa, mendoſa, dura, arcualia, tymparum, armalia, ſaxea, parietalia.

(b) *Albin.* de Oſſib. § 26.

extended horizontally forwards and inwards; which in its Progreſs becomes ſmaller, and is commonly called *Os petroſum.*

Three external Proceſſes of each temporal Bone are generally deſcribed.—The firſt placed at the lower and hind Part of the Bone, from its Reſemblance to a Nipple, is called *Maſtoides*, or *Mammillaris*. It is not ſolid, but within is compoſed of *Cancelli*, or ſmall Cells, which have a Communication with the large Cavity of the Ear, the Drum; and therefore Sounds, being multiplied in this vaulted Labyrinth, are increaſed, before they are applied to the immediate Organ of Hearing. Into the maſtoid Proceſs, the *Sternomaſtoideus* Muſcle is inſerted; and to its back Part, where the Surface is rough, the *Trachelomaſtoideus*, and part of the *Splenius* are fixed.—About an Inch farther forward, the ſecond Proceſs begins to riſe out from the Bone; and having its Origin continued obliquely downwards and forwards for ſome Way, it becomes ſmaller, and is ſtretched forwards to join with the *Os malæ;* they together forming the bony *jugum*, under which the temporal Muſcle paſſes. Hence this Proceſs has been named *Zygomatic.*[†] Its upper Edge has the ſtrong Aponeuroſis of the *temporal* Muſcle fixed into it; and its lower Part gives riſe to a Share of the *Maſſeter.*——The Fore-part of the Baſe of this Proceſs is an oblong Tubercle, which in a recent Subject is covered with a ſmooth poliſhed Cartilage, continued from that which lines the Cavity im-

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[†] καγκρος, Paris, anſæ oſſium temporum, oſſa arcualia, paria, jugalia, conjugalia.

mediately behind this Tubercle.—— From the under craggy Part of the *Os temporum*, the third Proceſs ſtands out obliquely forwards. The Shape of it is generally ſaid to reſemble the ancient *Stylus ſcriptorius;* and therefore it is called the *Styloid* Proceſs *. Some Authors (*a*) however contend, that it ought to be named *Steloid*, from its being more like to a Pillar. Several Muſcles have their Origin from this Proceſs, and borrow one half of their name from it; as *Stylo-gloſſus*, *Stylo-hyoideus*, *Stylo-pharyngeus;* to it a Ligament of the *Os hyoides* is ſometimes fixed; and another is extended from it to the inſide of the Angle of the lower Jaw. This Proceſs is often even in Adults not entirely oſſified, but is ligamentous at its Root, and ſometimes is compoſed of two or three diſtinct Pieces.— Round the Root of it, eſpecially at the Fore-part, there is a remarkable Riſing of the *Os petroſum*, which ſome have eſteemed a Proceſs; and, from the Appearance it makes with the *Styliform*, have named it *Vaginalis*. ——Others again have, under the Name of *Auditory* Proceſs, reckoned among the external Proceſſes that ſemicircular Ridge, which, running between the Root of the *maſtoid* and *Zygomatic* Proceſſes, forms the under-Part of the external *Meatus auditorius*.

The Sinuoſities or Depreſſions on the external Surface of each *Os temporum* are theſe: — A long *Foſſa* at the inner and back Part of the Root of the mammary Proceſs, where the poſterior Head of the *digaſtric* Muſcle has its Origin.——Immediately before the Root of the *zygomatic* Proceſs, a conſiderable Hollow is left, for lodging the *crotaphite* Muſcle.——Between the *zygomatic*, *auditory* and *vaginal* Proceſſes, a large Cavity is formed; through the Middle of which, from Top to Bottom, a Fiſſure is obſervable, into which Part of the Ligament that ſecures the Articulation of the lower Jaw with this Bone is fixed. The Fore-part of the Cavity being lined with the ſame Cartilage which covers the Tubercle before it, receives the *Condyle* of the Jaw; and in the Back-part a ſmall Share of the parotid Gland, and a cellular fatty Subſtance are lodged.—At the Inſide of the Root of the *ſtyloid Apophyſe*, there is a Thimble-like Cavity, where the beginning of the internal jugular Vein, or End of the lateral *Sinus* is lodged—And as the Sinuſes of the two Sides are frequently of unequal Size; ſo one of theſe Cavities is as often larger than the other (a).—Round the external *Meatus auditorius*, ſeveral Sinuoſities are formed for receiving the Cartilages and Ligaments of the Ear, and for their firm Adheſion.

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* Γραφοειδῆς, βελονοειδῆς, πληκτρὸν, Os calaminum, ſagittale, clavale, acuale, calcar capitis.

(*a*) *Galen*. de uſu Part. lib. 2. cap. 4. - *Fallop*. Obſerv. Anatom.

The *Holes* that commonly appear on the Outſide of each of theſe Bones, and are proper to each of them, are five.——The *firſt*, ſituated between the *zygomatic*, and *maſtoid* Proceſſes, is the Orifice of a large Funnel-like Canal, which leads to the Organ of Hearing; therefore

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(a) *Hunauld.* in Mem. de l'Acad. des Sciences, 1730.

fore is called *Meatus auditorius externus* ‡.—The *ſecond*, the *Aquæduct* of *Fallopius*, or Paſſage for the *Portio dura* of the auditory Nerve, is between the *maſtoid* and *ſtyloid* Proceſſes.—Some way before, and to the Inſide of the *ſtyloid* Proceſs, is the *third* Hole, the Canal from which runs firſt upwards, then forwards, and receives into it the internal *carotid* Artery, and the Beginning of the intercoſtal Nerve; where this Canal is about to make the Turn forwards, one, or ſometimes two very ſmall Holes go off towards the Cavity of the Ear called *Tympanum;* through theſe *Valſalva (a)* affirms the proper Artery or Arteries of that Cavity are ſent.—On the Anterior Edge of this Bone, near the former, a *fourth* Hole is obſervable, being the Orifice of a Canal, which runs outwards and backwards, in a horizontal Direction, till it terminates in the *Tympanum*. This, in the recent Subject, is continued forward and inward, from the Parts which I mentioned juſt now as its Orifice in the Skeleton, to the Side of the Noſtrils; being partly cartilaginous, and partly ligamentous. The whole Canal is named, *Iter a palato ad aurem*, or *Euſtachian Tube.*—On the external Side of the bony Part of this Canal, and a-top of the Chink in the Cavity that receives the *Condyle* of the lower Jaw, is the Courſe of the little Nerve ſaid commonly to be reflected from the lingual Branch of the fifth Pair, till it enters the *Tympanum*, to run acroſs this Cavity, and to have the Name of *Chorda Tympani*—The *fifth* Hole is very uncertain, appearing ſometimes behind the *maſtoid* Proceſs; ſometimes it is common to the temporal and occipital Bones; and in ſeveral Sculls there is no ſuch Hole. The Uſe of it, when found, is for the Tranſmiſſion of a Vein from the external Teguments to the lateral *Sinus*: But, in ſome Subjects, a Branch of the occipital Artery paſſes through this Hole, to ſerve the back Part of the *Dura Mater*; in others, I have ſeen two or three ſuch Holes: But they are oftener wanting than found. And we may, once for all, in general remark, That the Largeneſs, Number, Situation and Exiſtence of all ſuch Holes, that for the moſt part allow only a Paſſage for Veins from without to the internal Receptacles, are very uncertain.

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‡ Πόρος της ακοὴς, οπὴ τῶν ὤτων. Feneſtra aurium.

(a) De Aure humana, cap. 2. §. 22 et Tab. 7. Fig. I.

The internal Surface of the *Oſſa temporum* is unequal; the upper circular Edge of the ſquamous Part having numerous ſmall Ridges and Furrows for its Conjunction with the parietal Bones; and the reſt of it is irregularly marked with the Convolutions of the middle Part of the Brain, and with Furrows made by the Branches of the Arteries of the *Dura Mater*.

From the under Part of this internal Surface, a large tranſverſe hard craggy Protuberance runs horizontally inwards and forwards, with a harp Edge above, and two flat Sides, one facing obliquely forwards and outwards, and the other as much backwards and inwards. To the Ridge between theſe two Sides, the large lateral Proceſs of the *Dura Mater* is fixed.

Sometimes a ſmall Bone, a-kin to the Seſamoid, is found between the ſmall End of this *petrous* Proceſs and the *ſphenoid* Bone (*a*).

Towards the back Part of the Inſide of the *Os temporum*, a large deep *Foſſa* is conſpicuous, where the *lateral Sinus* lies; and frequently on the Top of the *petrous* Ridge, a Furrow may be obſerved, where a ſmall Sinus is ſituated.

The internal proper *Foramina* of each of theſe Bones are, *firſt*, the internal *Meatus auditorius* in the poſterior plain Side of the petrous Proceſs. This Hole ſoon divides into two; one of which is the Beginning of the *Aquæduct* of *Fallopius*; the other ends in ſeveral very ſmall Canals (*b*) that allow a Paſſage to the Branches of the *Portio mollis* of the ſeventh Pair of Nerves, into the *Veſtibule* and *Cochlea*. Through it alſo an Artery is ſent, to be diſtributed to the Organ of Hearing.——The *ſecond* Hole, which is on the anterior plain Side of the craggy Proceſs, gives Paſſage to a Branch of the lateral Artery of the *Dura Mater*, which joins the *Portio dura* of the auditory Nerve, while it is in the *Aquæduct* (*c*). Frequently, however, a Branch of the *Portio dura*, accompanied with a Branch of that Artery which went into the *Meatus auditorius* along with the acouſtick Nerve, enters into the *Cranium* here, to be diſtributed to the ſoft Parts, at the Side of the *Sella Turcica* (*d*).—Near to this ſecond Hole

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(*a*) *Riolan*, Comment de Oſſib. cap. 32.——*Winſlow*, Expoſition Anatomique de corps humain, Trait. des Os Secs, §. 266.

(*b*) *Valſalv.* De aure humana, cap. 3. § 11.

(*c*) *Fallop*, Obſ. Anatom.

(*d*) *Valſalv.* De aure, cap. 3. § 10.

Hole, there are often ſeveral ſmall ones, where Arteries or Twigs of Nerves enter. On the poſterior Surface, near the auditory *Foramen*, other ſmall Holes may be taken Notice of: They ſeem only to convey Veſſels to the Subſtance of the Bone.——The Paſſage of the cutaneous Vein into the lateral *Sinus*, or of a Branch of the occipital Artery, is ſeen about he Middle of the large *Foſſa* for that *Sinus*; and the Orifice of the Canal of the *carotid* Artery, is evident at the under Part of the Point of the *petrous* Proceſs.

Beſides theſe proper Holes of the temporal Bones which appear on their external and internal Surfaces, there are two others in each Side hat are common to this Bone, and to the *occi- ital* and *ſphenoidal* Bones; which ſhall be men- ioned afterwards in the Deſcription of theſe Bones.

The upper round Part of the ſquamous Bones s thin, but equal; while the low petrous Part s thick and ſtrong, but irregular and unequal, aving the Diſtinction of Tables and *Diploe* onfounded, with ſeveral Cavities, Proceſſes, nd Bones within its Subſtance, which are Parts f the Organ of Hearing. That a clear Idea nay be had of this beautiful, but intricate Or- an, Anatomiſts generally chuſe to demonſtrate ll its Parts together. I think the Method ood; and therefore, ſince it would be impro- er to inſert a compleat Treatiſe on the Ear ere, ſhall omit the Deſcription of the Parts ontained within the *Os petroſum* of the Skele- on.

The temporal Bones are joined above to t
parietal Bones by the ſquamous Sutures, a
their poſterior *Additamenta*: Before, to t
ſphenoid Bone by the Suture of that Name; t
the Cheek Bones by the *zygomatic* Sutures: B
hind, to the *occipital* Bone, by the *Lambdoid* S
ture and its *Additamenta;* and they are artic
lated with the *lower Jaw*, in the Manner whi
ſhall be deſcribed when this Bone is examined

The Purpoſes which theſe two Bones ſerv
are eaſily collected, from the general Uſe
the *Cranium*, and from what has been ſaid
the Deſcription of their ſeveral Parts.

In an Infant, a ſmall Fiſſure is to be obſer
ed between the thin upper Part, and the low
craggy Part of each of theſe Bones; whic
points out the recent Union of theſe Parts.—
Neither *maſtoid* nor *ſtyloid* Proceſſes are yet t
be ſeen——Inſtead of a bony Funnel-like exte
nal *Meatus auditorius*, there is only a ſmoot
bony Ring, within which the Membrane of th
Drum is faſtened.——At the Entry of the *E*
ſtachian Tube, the Side of the *Tympanum* is n
completed.——A little more outward than th
internal auditory Canal, there is a deep Pit,
ver the upper Part of whoſe Orifice the interi
ſemicircular Canal of the Ear is ſtretched; a
ſome Way below this, the poſterior ſemicirc
lar Canal alſo appears manifeſtly.

OS OCCIPITIS *, ſo called from its S
tuation, is convex on the Outſide, and conca
internally. Its Figure is an irregular Squar
or rather *Rhomboid;* of which the Angle abo

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* Ἰνίον, Baſilare, Proræ, Memoriæ, Pixidis, Fibroſum, Ne
voſum, Lambde.

is generally a little rounded; the two lateral Angles are more finiſhed, but obtúſe; and the lower one is ſtretched forward in Form of a Wedge, and thence is called by ſome the *cuneiform* Proceſs.—If one would, however, be very nice in obſerving the ſeveral Turns which the Edges of the *Os occipitis* make, five or ſeven Sides, and as many Angles of this Bone, might be deſcribed.

The external Surface is convex, except at the cuneiform Apophyſe, where it is flatted. At the Baſe of this triangular Proceſs, on each Side of the great Hole, but more advanced forwards than the Middle of it, the large oblong Protuberances, named the *Condyles*, appear, to ſerve for the Articulation of this Bone with the firſt *Vertebra* of the Neck. The ſmooth Surface of each of theſe *Condyloid* Proceſſes is longeſt from behind forwards, where, by their oblique Situation, they come much nearer to each other than they are at their Back-part. Their inner Sides are lower than the external, by which they are prevented from ſliding to either Side out of the Cavities of the firſt *Vertebra* (*a*). In ſome Subjects each of theſe plain ſmooth Surfaces ſeems to be divided by a ſmall Riſing in its Middle; and the lower Edge of each Condyle, next the great *Foramen*, is diſcontinued about the Middle, by an interveening Notch: whence ſome (*b*) alledge, that each of theſe *Apophyſes* is made up of two Protuberances.—Round their Root a ſmall Depreſſion and

ſpongy

(*a*) *Galen.* de uſu Part. lib. 12. cap. 7.
(*b*) *Diemerbroeck*, Anat. lib. 9. cap. 6.

ſpongy Roughneſs is obſervable, where the Ligaments for ſurrounding and ſecuring their Articulations adhere.—Though the Motion of the Head is performed on the Condyles, yet the Center of Gravity of that Globe does not fall between them, but is a good Way further forward; from which Mechaniſm it is evident, that the Muſcles which pull the Head back, muſt be in a conſtant State of Contraction; which is ſtronger than the natural Contraction of the proper Flexors, elſe the Head would always fall forwards, as it does when a Man is aſleep, or labours under a Palſy, as well as in Infants, where the Weight of the Head far exceeds the proportional Strength of theſe Muſcles. This ſeeming diſadvantageous Situation of the Condyles is however of good Uſe to us, by allowing ſufficient Space for the Cavities of the Mouth and *Fauces*, and for lodging a ſufficient Number of Muſcles, which commonly ſerve for other Uſes; but may at Pleaſure be directed to act on the Head, and then have an advantageous Lever to act with, ſo as to be able to ſuſtain a conſiderable Weight appended, or other Force applied, to pull the Head back.

Somewhat more externally than the *Condyles*, there is a ſmall Riſing and ſemilunated Hollow in each Side, which make up Part of the Holes, common to the occipital and *petrous* Bones. Immediately behind this, on each Side, a ſcabrous Ridge is extended from the Middle of the Condyle, towards the Root of the *Maſtoid* Proceſs. Into this Ridge the *Muſculus lateralis*, commonly aſcribed to *Fallopius*, is inſerted.—About the Middle of the external convex Surface, a large

Arch runs croſs the Bone; from the upper lateral Parts of which the *occipital* Muſcles have their Riſe; to its Middle the *Trapezii* are attached; and half Way between this and the great Hole, a leſſer Arch is extended.—In the Hollows between the Middle of theſe Arches, the *Complexi* are inſerted; and in the Depreſſions more external and further forward than theſe, the *Splenii* are inſerted.—Between the Middle of the leſſer Arch and the great Hole, the little hollow Marks of the *recti minores* appear; and on each Side of theſe the fleſhy Inſertions of the *obliqui ſuperiores* and *recti majores* make Depreſſions.—Through the Middle of the two Arches a ſmall ſharp *Spine* is placed, which ſerves as ſome Sort of Partition between the Muſcles of different Sides, or rather is owing to the Action of the Muſcles depreſſing the Bone on each Side of it, while this Part is free from their Compreſſion.—Theſe Prints of the Muſcles on this Bone are very ſtrong and plain in ſome Subjects, but are not ſo diſtinct in others.—All round the great *Foramen* the Edges are unequal, for the firmer Adheſion of the ſtrong circular Ligament which goes thence to the firſt *Vertebra.*—One End of each *lateral* or *moderator* Ligament of the Head, is fixed to a rough Surface at the Fore-part of each Condyle, and the *perpendicular* one is connected to a rough Part of the Edge of the great Hole between the two Condyles.—Immediately before the Condyles, two little Depreſſions are made in the external Surface of the cuneiform Proceſs, for the Inſertion of the *recti anteriores minores* Muſcles, which are unjuſtly aſcribed to *Cowper:* And ſtill further forward, nearer the *ſphenoid* Bone, are two other ſuch Depreſſions, for the Reception of the *recti anteriores majores*.—When we conſider the Size of the Prints of Muſcles on the occipital Bone, before and behind its Condyles, and, at the ſame Time, compare their Diſtances from theſe Centers of Motion of the Head, we muſt ſee how much ſtronger the Muſcles are which pull the Head backwards, than thoſe are which bend it forward; and how much greater Force the former acquire by the long Lever they act with, than the latter which are inſerted ſo near the Condyles. This great Force in the extenſor Muſcles is altogether neceſſary, that they might not only keep the Head from falling forward in an erect Poſture, but that they might ſupport it when we bow forward in the moſt neceſſary Offices of ſocial Life, when the Weight of the Head comes to act at right Angles on the *Vertebræ* of the Neck, and obtains a long Lever to act with.

On the inner Surface of the *Os occipitis* we ſee two Ridges; one ſtanding perpendicular, the other running horizontally acroſs the firſt. The upper Part of the perpendicular Limb of the Croſs, to which the *Falx* is fixed, is hollowed in the Middle, or often in one Side, for the Reception of the *ſuperior longitudinal Sinus*, and the lower Part of it has the ſmall or third Proceſs of the *Dura Mater* faſtened to it, and is ſometimes hollowed by the *occipital Sinus*. Each Side of the horizontal Limb is made hollow by the lateral Sinuſes incloſed in the tranſverſe Proceſs of the *Dura Mater*; the *Foſſa* in the right Side being generally a Continuation of the one made by the longitudinal Sinus in the perpendicular Limb, and therefore is larger than the left one (*a*).—Round the Middle of the Croſs there are four large Depreſſions ſeparated by its Limbs; the two upper ones being formed by the Back-part of the Brain, and the two lower ones by the *Cerebellum.*——Farther forward than the laſt mentioned Depreſſions, is the lower Part of the *Foſſa* for the lateral *Sinus* on each Side.——The inner Surface of the cuneiform Apophyſe is made concave for the Reception of the *Medulla oblongata*, and of the *Baſilar* Artery.—A Furrow is made on each Side, near the Edges of this Proceſs, by a *Sinus* of the *Dura Mater*, which empties itſelf into the lateral *Sinus* (*b*).

The Holes of this Bone are commonly five proper, and two common to it and to the *temporal* Bones.—The firſt of the proper Holes, called *Foramen magnum* * from its Size, is immediately behind the Wedge-like Proceſs, and allows a Paſſage to the *Medulla oblongata*, *Nervi acceſſorii*, to the vertebral Arteries, and ſometimes to the vertebral Veins.——At each Side of this great Hole, near its Fore-part, and immediately above the Condyles, we always find a Hole, ſometimes two, which ſoon unite again into one that opens externally; thro' theſe the ninth Pair of Nerves go out of the Scull.—The fourth and fifth Holes pierce from behind the *Condyle* of each Side into the *Foſſæ* of the lateral *Sinuſes*; they ſerve for the Paſſage of

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(*a*) *Morgagn.* Adverſ. Anat. 6. Animad. 1.
(*b*) *Albin.* de Oſſib. § 65.
* Rachitidis, Medullæ ſpinalis.

the cervical Veins to theſe *Sinuſes*. Often one of theſe Holes is wanting, ſometimes both, when the Veins paſs thro' the great *Foramen*.—Beſides theſe five, we frequently meet with other Holes near the Edges of this Bone, for the Tranſmiſſion of Veins; but their Number and Diameter are very uncertain.—The two common *Foramina* are the large irregular Holes, one in each Side, between the Sides of the *cuneiform* Proceſs, and the Edges of the *petrous* Bones. In a recent Subject, a ſtrong Membrane runs croſs from one Side to the other of each of theſe Holes; in ſome Heads I have ſeen this Membrane oſſified, or a bony Partition dividing each Hole; and, in the greater Number of adult Sculls, there is a ſmall ſharp-pointed Proceſs ſtands out from the *Os petroſum*, and a more obtuſe Riſing in the occipital Bone, between which the Partition is ſtretched. Behind this Partition, where the largeſt Space is left, the *lateral Sinus* has its Paſſage; and before it the eight Pair of Nerves and *Acceſſorius* make their Exit out of the Scull; and ſome Authors ſay, an Artery paſſes through this Hole, to be beſtowed on the *Dura Mater*.

The *occipital* Bone is among the thickeſt of the *Cranium*, though unequally ſo; for it is ſtronger above, where it has no other Defence than the common Teguments, than it is below, where, being preſſed by the Lobes of the Brain and *Cerebellum* on one Side, and by the Action of the Muſcles on the other, it is ſo very thin, as to be diaphanous in many Sculls: But then theſe Muſcles ward off Injuries, and the Ridges and Spines, which are frequent here, make it ſufficiently ſtrong to reſiſt ordinary Forces. The Tables and *Diploe* are tolerably diſtinct in this Bone, except where it is ſo thin as to become diaphanous.

The occipital Bone is joined above to the *Oſſa parietalia* and *Triquetra* when preſent, by the *Lambdoid* Suture;——laterally to the temporal Bones, by the *Additamenta* of the *Lambdoid* Suture;——below to the *ſphenoid* Bone, by the End of its cuneiform Proceſs, in the ſame Way that Epiphyſes and their Bones are joined: For, in Children, a ligamentous Cartilage is interpoſed between the occipital and ſphenoid Bones, which gradually turns thinner, as each of the Bones advances, till their Fibres at laſt run into each other; and, about ſixteen or eighteen Years of Age, the Union of theſe two Bones becomes ſo intimate, that a Separation cannot be made without Violence.——The *Os occipitis* is joined by a double Articulation to the firſt *Vertebra* of the Neck, each Condyle being received into a ſuperior oblique Proceſs of that *Vertebra*. What Motion is allowed here, we ſhall conſider afterwards, where the *Vertebræ* are deſcribed.

The Uſes of this Bone appear from the preceeding Deſcription, and therefore need not be repeated.

An Infant born at the full Time, has this Bone divided, by unoſſified Cartilages, into four Parts.——The firſt of theſe is larger than the other three, is of a triangular Shape, and conſtitutes all the Part of the Bone above the great *Foramen*. Generally Fiſſures appear in the upper Part and Sides of this triangular Bone, when all the Cartilage is ſeparated by Maceration; and ſometimes little diſtinct Bones are ſeen towards the Edges of it.—The ſecond and third Pieces of this Bone are exactly alike, and ſituated on each Side of the great *Foramen*; from which very near the whole Condyles are produced; and they are extended forwards almoſt to the Fore-part of the Hole for the ninth Pair of Nerves.—The fourth Piece is the cuneiform Proceſs, which forms a ſmall Share of the great Hole, and of theſe for the ninth Pair of Nerves, and of the Condyles: Betwixt it and the *ſphenoid* Bone, a Cartilage is interpoſed.

Of the eight Bones which belong to the *Cranium*, there are only two which are not yet deſcribed, *viz.* the *Ethmoid* and *Sphenoid*. Theſe we already mentioned, in Complaiſance to the Generality of Writers on this Subject, as Bones common to the *Cranium* and Face, becauſe they enter into the Compoſition of both: But the ſame Reaſon might equally be uſed for calling the frontal Bone a common one too. I ſhall, however, paſs any idle Diſpute about the Propriety of ranging them, and proceed to examine the Structure of the Bones themſelves.

OS ETHMOIDES *, or the Sieve-like Bone, has got its Name from the great Number of ſmall Holes with which that Part of it firſt taken Notice of is pierced. When this Bone is entire, the Figure of it is not eaſily deſcribed; but, by a Detail of its ſeveral Parts, ſome Idea may be afforded of the whole; and therefore I ſhall diſtinguiſh it into the *Cribri-*

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* Cribriforme, σπογγοειδὴς, Spongiforme.

form Lamella with its Proceſs, the *Naſal Lamella, Cellulæ*, and *Oſſa ſpongioſa.*

The thin horizontal *Lamella*, is all (except its Back-part) pierced obliquely by a great Number of ſmall Holes, through which the Filaments of the olfactory Nerves paſs. In a recent Subject, theſe Holes are ſo cloſely lined by the *Dura Mater*, that they are much leſs conſpicuous than in the *Skeleton.*——From the Middle of the internal Side of this Plate, a thick Proceſs riſes upwards, and, being higheſt at the Fore-part, gradually becomes lower, as it is extended backwards. From ſome Reſemblance which this Proceſs was imagined to have to a Cock's Comb, it has been called *Criſta galli* †. The *Falx* is connected to its Ridge, and to the unperforated Part of the cribriform Plate.——When the *Criſta* is broke, its Baſe is ſometimes found to be hollow, with its Cavity opening into the Noſe (*a*).——Immediately before the higheſt Part of this Proceſs, is the blind Hole of the *frontal* Bone, which, as was formerly remarked, is often in a good Meaſure formed by a Notch in the Fore-part of the Root of the *Criſta.*

From the Middle of the outer Surface of the *Cribriform Lamella*, a thin ſolid Plate is extended downwards and forwards, having the ſame common Baſe with the *Criſta galli.* Generally it is not exactly perpendicular, but is inclined to one Side or other, and therefore divides the Cavity of the Noſe unequally. Its Inclination to one Side, and Flexure in the Middle, is ſome-times ſo great, that it fills up a large Share o one of the Noſtrils, and has been miſtook fo a *Polypus* there.—It is thin at its Riſe, and rather ſtill thinner in its Middle; yet afterwards, towards its lower Edge, it becomes thicker, that its Conjunction with the Bones and middl Cartilage of the Noſe might be firmer.

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† Verruca prædura, ſeptum oſſis ſpongioſi.

(*a*) *Palfyn.* Anat. Chir. Tr. 4. Chap. 15.

At a little Diſtance from each Side of thi external Proceſs, a cellular and ſpongy bony Subſtance depends from the cribriform Plate. The Number and Figure of the Cells in this irregular Proceſs of each Side, are very uncertain, and not to be repreſented in Words; only the Cells open into each other, and into the Cavity of the Noſe: The uppermoſt, which are below the Aperture of the frontal *Sinuſes*, are formed like Funnels.——The outer Surface o theſe Cells is ſmooth and plain, where this Bone aſſiſts in compoſing the Orbit; at which Place, on each Side, it has got the Name of *Os planum*; on the upper Edge of which, a ſmal Notch or two may ſometimes be obſerved, which go to the Formation of the internal orbitar Holes; as was remarked in the Deſcriptio of the frontal Bone.

Below the Cells of each Side, a thin Plate is extended inwards, and then bending down, it becomes thick and of a ſpongy Texture.——This ſpongy Part is triangular, with a ſtreight upper Edge placed horizontally, an anterior one ſlanting from above, downwards and forwards, and with a pendulous convex one below.—The upper and lower Edges terminate in a ſharp Point behind.—The Side of this pendulous ſpongy Part next to the *Septum Narium* is convex, and its external Side is concave.——Theſe two Proceſſes of the *ethmoid* Bone have got the Name of *Oſſa ſpongioſa*, or *Turbinata ſuperiora*, from their Subſtance, Figure, and Situation.

All the Prominencies, Cavities and *Meanders* of this *ethmoid* Bone, are covered with a Continuation of the Membrane of the Noſtrils, in a recent Subject.——Its horizontal cribriform Plate is lodged between the orbitar Proceſſes of the *frontal* Bone, to which it is joined by the *ethmoid* Suture, except at the Back-part, where it is connected with the *Cuneiform* Bone, by a Suture common to both theſe Bones, though it is generally eſteemed Part of the *ſphenoidal*.——Where the *Oſſa plana* are contiguous to the frontal Bone within the Orbit, their Conjunction is reckoned Part of the tranſverſe Suture.——Farther forward than the *Oſſa plana*, the Cells are covered by the *Oſſa unguis*, which are not only contiguous to theſe Cells, but cannot be ſeparated from them, without breaking the bony Subſtance; and therefore, in Juſtice, thoſe Bones ought to be demonſtrated as Part of the *ethmoid* Bone.——Below the *Oſſa unguis* and *plana*, theſe Cells and *Oſſa ſpongioſa* are overlopped by the *maxillary* Bones.——The cellular Part of each *palate* Bone is contiguous to each *Os planum* and Cells backwards.—The lower Edge of the Naſal perpendicular Plate is received into a Furrow of the *Vomer*.——Its poſterior Edge is joined to the Fore-part of the *Proceſſus azygos* of the *ſphenoid* Bone.——Its upper Edge joins the *Naſal* Proceſs of the *frontal* and *naſal* Bones, and its anterior one i connected to the middle Cartilage of the Noſe

From all which, the Uſes of this Bone are evident, *viz.* to ſuſtain the anterior Lobes of th Brain; to give Paſſage to the olfactory Nerve and Attachment to the *Falx*; to enlarge th Organ of Smelling, by allowing the Membran of the Noſe a great Extent; to ſtraiten th Paſſage of the Air through the Noſe, by leaving only a narrow winding Canal, on the ſenſible membranous Sides of which the Subſtance conveyed along with the Air muſt ſtrike; t form Part of the Orbit of the Eyes and *Septum narium*; while all its Parts are ſo light, as no to be in Hazard of ſeparating by their Weight and they are ſo thin, as to form a large Surface without occupying much Space. This brittl Subſtance, however, is ſufficiently protecte from external Injuries by the firm Bones whic cover it.

If this Bone is ſeized on by any corrodin Matter, we may eaſily conceive what Deſtruction may enſue. Hence it is, that an *Ozæna* i difficult to cure; and that, in violent *Scurvies* or in the *Lues Venerea*, the Fabrick of the Noſe the Eyes, and Life itſelf are in Danger.—Th Situation of the Naſal Plate may ſhew us, how dangerous a Fracture of the Bones of the Noſ may be, when made by a Force applied to thei middle Fore-part, of a Perſon in whom thi naſal Plate is perpendicular.

The *Ethmoid* Bone of ripe Children is divided into two, by a perpendicular Cartilage which, when oſſified, is the *Criſta galli*, and Na

ſai

ſal Plate: But its other Parts are oſſified and compleat.

OS SPHENOIDES *, or Wedge-like Bone, ſo called becauſe of its Situation in the Middle of the Bones of the *Cranium* and Face, is of ſuch an irregular Figure, that I know not any Thing to which it may be likened, unleſs, perhaps, it bear ſome faint Reſemblance to a Bat with its Wings extended.

When we view the Outſide of the *Os ſphenoides*, five remarkable Proceſſes may be obſerved, which are all of them again ſubdivided.—The firſt and ſecond are the two large lateral Proceſſes or Wings; the upper Part of each of which is called the *temporal Proceſs*, becauſe they join with the temporal Bones in forming the Temples, and the Seat for ſome Share of the *crotaphite* Muſcles. That Part of the Wings which jutts out towards the Inſide, ſomewhat lower than the temporal *Apophyſes*, and is ſmooth and hollowed, where it makes up Part of the Orbit, is thence named *orbitar Proceſſes*. Behind the Edge, ſeparating theſe two Proceſſes, there is often a ſmall Groove, made by a Branch of the ſuperior maxillary Nerve, in its Paſſage to the temporal Muſcle. The loweſt and back Part of each Wing, which runs out ſharp to meet the *Oſſa petroſa*, has been ſtyled the *ſpinous* Proceſs: From near the Point of which a ſharp-pointed Proceſs is frequently produced downwards, which ſome call *Styliform*, that affords Origin to the *Ptery-ſtaphylinus exter-*

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* Cuneiforme, πολύμορφον, multiforme, paxillum, cribratum, palati, colatorii, cavilla, baſilare.

nus Muſcle. From this ſtyloid Proceſs a very ſmall Groove is extended along the Edge of the Bone to the Hollow at the Root of the internal Plate of the following Proceſſes, which forms Part of the *Euſtachian* Tube (*a*).—The third and fourth external Proceſſes of the *cuneiform* Bone, are the two which ſtand out almoſt perpendicular to the Baſe of the Scull. Each of them has two Plates, and a middle *Foſſa* facing backwards, and ſhould, to carry on our Compariſon, be likened to the Bat's Legs, but are commonly ſaid to reſemble the Wings of that Creature; and therefore are named *Pterygoid* or *Aliform* * Proceſſes. The external Plates are broadeſt, and the internal are longeſt. From each Side of the external Plates the *pterygoid* Muſcles take their Riſe. At the Root of each internal Plate, a ſmall Hollow may be remarked, where the *Muſculus ptery-ſtaphylinus internus*, or *circumflexus palati* riſes, and ſome Share of the cartilaginous End of the *Euſtachian* Tube reſts; and, at the lower End of the ſame Plate, is a Hook-like Riſing or Proceſs, round which the Tendon of the laſt named Muſcle plays, as on a Pulley. From the Edge of the external Plates ſome ſmall ſharp Spikes ſtand out; but their Number and Bulk are uncertain.——The fifth external Proceſs of the *ſphenoid* Bone is that ſharp middle Ridge which ſtands out from its Baſe: Becauſe it wants a Fellow, it may be called *Proceſſus azygos*. The lower Part of this Proceſs, where it is received

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(*a*) *Winſlow*, Expoſition Anatomique du corps humain Traité des Os ſecs, § 233.

* Naviculares.

into the *Vomer*, is thick, and often not quite perpendicular, but inclining more to one Side than the other. The Fore-part of this Proceſs, where it joins the Naſal Plate of the *Os Ethmoides*, is thin and ſtreight. Theſe two Parts have been deſcribed as two diſtinct Proceſſes by ſome.

The Depreſſions, Sinuoſities and *Foſſæ*, on the external Surface of this *ſphenoid* Bone, may be reckoned up to a great Number, *viz.* two on the temporal *Apophyſes* where the *crotaphite* Muſcles lodge—Two on the *orbitar* Proceſſes, to make way for the Globes of the Eyes.——Two between the *temporal* and *ſpinous* Proceſſes for receiving the temporal Bones.——Two between the Plates of the *pterygoid* Proceſſes, where the *Muſculi pterygoidei interni* and *Ptery-ſtaphylini interni* are placed.——Two between the *pterygoid* and *orbitar* Proceſſes, for forming the Holes, common to this, and to the *Cheek* and *maxillary* Bones. Two on the lower Ends of the *aliform* Proceſſes, which the *palate* Bones enter into.——Two at the Roots of the *temporal* and *pterygoid* Proceſſes, where the largeſt Share of the external *pterygoid* Muſcles have their Riſe.——Two at the Sides of the *Proceſſus azygos*, for forming Part of the Noſe, *&c.*

What I deſcribed under the Name of *temporal* and *ſpinous Proceſſes* on the Out-ſide of the Scull, are likewiſe ſeen on its Inſide, where they are concave, for receiving Part of the Brain; and commonly three *Apophyſes* on the internal Surface of the *ſphenoid* Bone are only mentioned——Two riſing broad from the Fore-part of its Body, become ſmaller as they are extended obliquely backwards.——The third ſtanding on a long tranſverſe Baſe, near the Back-part of the Body of this Bone, riſes nearly erect, and of an equal Breadth, terminating often in a little Knob on each Side. The three are called *Clinoid*, from ſome reſemblance which they were thought to have to the Supporters of a Bed. Sometimes one or both the anterior *clinoid* Proceſſes are joined to the Sides of the poſterior one, or to the Body of the Bone itſelf.—From the Roots of the anterior *clinoid* Proceſſes the Bone is extended on each Side outwards and forwards, till it ends in a ſharp Point, which may have the Name of the *Tranſverſe ſpinous* Proceſſes.——Between, but a little farther back than the two anterior *clinoid* Proceſſes, we ſee a Protuberance conſiderably ſmaller than the poſterior *clinoid* Proceſs, but of its Shape.——Another Proceſs often forces itſelf forwards into the *Os Ethmoides*, from between the tranſverſe Proceſſes.

Within the Scull, there are two Sinuoſities in the internal Part of each Wing of the *ſphenoid* Bone, for receiving the middle Part of the Brain.——One between the tranſverſe ſpinous Proceſſes, for lodging the Part of the Brain where the *Crura medullæ oblongatæ* are.—Immediately before the third or middle *clinoid* Proceſs, a ſingle Pit generally may be remarked, from which a *Foſſa* goes out on each Side to the Holes through which the optic Nerves paſs. The Pit is formed by the conjoined optic Nerves; and in the *Foſſæ* theſe Nerves are lodged, as they run divided within the Scull.—Between that third Protuberance and the poſterior *clinoid* Proceſs, the large Pit for the *Glandula pituitara* may be remarked. This Cavity, becauſe of its Reſemblance to a *Turkiſh* Saddle, is always deſcribed under the Name of *Sella Turcica*, or *Ephippium.*——On the Sides of the poſterior *clinoid* Proceſs a *Foſſa* may be remarked, that ſtretches upwards, then is continued forwards along the Sides of the *Sella Turcica*, near to the anterior *clinoid* Proceſſes, where a Pit on each Side is made. Theſe *Foſſæ* point out the Courſe of the two internal *carotid* Arteries after they have entered the Scull.——Beſides all theſe, ſeveral other *Foſſæ* may be obſerved, leading to the ſeveral Holes, and imprinted by the Nerves and Blood-veſſels.

The Holes on each Side of the *Os ſphenoides* are ſix proper, and three common.——The *firſt* is the round one immediately below the anterior *clinoid* Proceſſes, for the Paſſage of the optic Nerve, and of the Branch of the internal *carotid* Artery that is ſent to the Eye.——The *ſecond* is the *Foramen lacerum*, or large Slit between the tranſverſe ſpinous and orbitar Proceſſes: The interior End of which Slit is large; and, as it is extended outwards, it becomes narrower. The outer End of it is formed in the *Os frontis*; and therefore this might be reckoned among the common *Foramina*. Through it the third, fourth, the firſt Branch of the fifth, and the greater Share of the ſixth Pair of Nerves, and an Artery from the internal Carotid, go into the Orbit. Sometimes a ſmall Branch of the external Carotid enters near its End; to be diſtributed to the *Dura Mater* (*a*), and a Vein, ſome call it the *Venous Duct*, or, *Nuck's Aquæduct*, returns through it to the cavernous *Sinus*.——The *third* Hole, ſituated a little behind the one juſt now deſcribed, is called *Rotundum*, from its Shape. It allows paſſage to the ſecond Branch of the fifth Pair of Nerves, or ſuperior maxillary Nerve, into the Bottom of the Orbit——The *fourth* is the *Foramen ovale*, about half an Inch behind the round Hole. Through it the third Branch of the fifth Pair, or inferior *maxillary* Nerve, goes out; and ſometimes a Vein from the *Dura Mater* paſſes out here (*b*).——Very near the Point of the ſpinous Proceſs is the *fifth* Hole of this Bone: It is ſmall and round, for a Paſſage to the largeſt Artery of the *Dura Mater*, which often is accompanied with a Vein.——The *ſixth* proper Hole (*c*) cannot be well ſeen, till the cuneiform Bone is ſeparated from all the other Bones of the *Cranium*; for one End of it is hid by a ſmall Protuberance of the internal Plate of the *pterygoid* Proceſs, and by the Point of the *Proceſſus petroſus* of the *temporal* Bone. Its Canal is extended above the inner Plate of the *pterygoid* Proceſs; and where it opens into the Cavity of the Noſe, it is concealed by the thin laminous Part

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(*a*) *Winſlow*, Expoſition Anatomique de corps humain, Traitè des Arteres, §. 60. & de la Tete, §. 26.

(*b*) *Ingraſſ*. Commentar. in *Galen*. de Oſſib. lib. 1. comment. 8.

(*c*) *Veſal*. Anat. lib. 1. cap. 12.—*Euſtach*. Tab. 46. Fig. 13. & 16.—*Vidus Vidius*, Anat. lib. 2. cap. 2. Explicat. Tab. 5. & Tab. 5. Fig. 8. 9. 10. lit. O.

Part of the *palate* Bone. Through it an Artery from the external *Carotid* runs, to be diſtributed to the Noſtrils: So that as this Hole does not open within the *Cranium*, it differs from all the other *Foramina* of this Bone already deſcribed. In ſeveral Subjects, ſoon after the Entry of this Artery, a ſmall Branch goes backwards from it to the *Foſſa pterygoidea*, and a ſecond enters the Scull to ſerve the *Dura Mater*.——Often in the Middle of the *Sella Turcica* a ſmall Hole or two pierce as far as the cellular Subſtance of the Bone; and ſometimes at the Sides of this *Sella*, one or more ſmall Holes penetrate into the *ſphenoidal Sinuſes*. Theſe Obſervations afforded ſome Anatomiſts (*a*) an Argument of Weight in their Days in defence of *Galen* (*b*), who aſſerted the Deſcent of the *Pituita* that Way into the *Sinuſes* below.

The *firſt* of the common Holes is that unequal Fiſſure at the Side of the *Sella Turcica*, between the extreme Point of the *Os petroſum* and the *ſpinous* Proceſs of the cuneiform Bone. This Hole only appears after the Bones are boiled; for, in a recent Subject its Back-part is covered by a thin bony Plate that lies over the internal carotid Artery, and further forward it is filled with a cartilaginous Ligament, under which the cartilaginous Part of the *Euſtachian* Tube is placed: Sometimes, however, a Branch of that Artery which enters the ſixth Hole of the ſphenoid Bone, is ſent through this Subſtance to the *Dura Mater*. It was by this Paſſage that the Ancients believed the *ſlimy Matter* was

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(*a*) *Jac. Sylv.* Calumniæ ſecundæ amolitio.—*Laurent.* Hiſt. Anat. lib. 2. quæſt. 11.

(*b*) *Galen.* De uſu Part. lib. 9. cap. 1.

was conveyed from the Emunctory of the Brain, the *Glandula pituitaria*, to the *Fauces*.——The *ſecond* common Hole is the large Diſcontinuation of the external Side of the Orbit, left between the orbitar Proceſſes of the cuneiform Bone, the *Os maxillare*, *malæ*, and *palati*. In this large Hole the Fat for lubricating the Globe of the Eye and temporal Muſcle is lodged, and Branches of the ſuperior maxillary Nerve, with ſmall Arteries from the Carotid and Veins paſs.——The *third* Hole is formed between the Baſe of this Bone and the Root of the Orbitar Proceſs of the Palate-bone of each Side. Through this a Branch of the external carotid Artery, and of the ſecond Branch of the fifth Pair of Nerves, are allowed a Paſſage to the Noſtrils, and a returning Vein accompanies them. Sometimes, however, this Hole is proper to the Palate-bone, being entirely formed out of its Subſtance.

Under the *Sella Turcica*, and ſome Way farther forward, but within the Subſtance of the *ſphenoid* Bone, are two *Sinuſes*, ſeparated by a bony Plate. Each of them is lined with a Membrane, and opens into the upper and Back-part of each Noſtril by a round Hole, which is at their upper Fore-part. This Hole is not formed only by the *Os ſphenoides*, which has an Aperture near as large as any tranſverſe Section of the *Sinus*, but alſo by the *Palate* Bones which are applied to the Fore-part of theſe *Sinuſes*, and cloſe them up, that Hole only excepted, which was already mentioned. Frequently the two *Sinuſes* are of unequal Dimenſions, and ſometimes there is

only

nly one large Cavity, with an Opening into
ne Noſtril. Theſe Cavities are likewiſe ſaid
a) to be extended ſometimes as far back as
he great *Foramen* of the occipital Bone. In
ther Subjects they are not to be found, when
he Bone is compoſed of large Cells (*b*). Some
c) mention a Cavity within the Partition of the
inuſes; but it is ſmall.—The *ſphenoidal Sinuſes*
erve the ſame Uſes as the frontal do.

As this Bone is extremely ragged and une-
ual, ſo its Subſtance is of very different Thick-
eſs, being in ſome Places diaphanous; in o-
hers it is of a middle Thickneſs, and its mid-
le Back-part ſurpaſſes the greateſt Share of the
ranium in Thickneſs.

The *Os ſphenoides* is joined, by its Wings,
o the *parietal* Bones above, to the *Os frontis*
nd *Oſſa malarum* before, to the *temporal* Bones
ehind;——by the Fore-part of its Body and
pinous Proceſſes, to the *frontal* and *Ethmoid*
ones;—by its Back-part, behind the two *Sinuſ-*
s, to the *occipital*, where it looks like a Bone
ith the *Epiphyſes* taken off, and, as was for-
erly obſerved in the Deſcription of the occi-
ital Bone, it cannot be ſeparated without Vio-
ence in Adults;——to the *Palate* Bones, by
he Ends of the *pterygoid* Proceſſes, and ſtill
ore by the Fore-part of the internal Plates of
he *pterygoid* Proceſſes, and of the *Sinuſes*;—to
he *maxillary* Bones, by the Fore-part of the
xternal *pterygoid* Plates;—to the *Vomer* and
aſal Plate of the *Os Ethmoides*, by the *Pro-*

ceſſus

(*a*) *Albin.* de Oſſib. § 39.
(*b*) *Veſal.* lib. 1. cap. 6.
(*c*) Id. ibid.

ceſſus azygos. All theſe Conjunctions, except the laſt, which is a *Schindyleſis*, are ſaid to be by the Suture proper to this Bone; though it is at firſt Sight evident, that ſeveral other Sutures, as the *tranſverſe*, *ethmoidal*, *&c.* are confounded with it.

We ſee now how this Bone is joined to all the Bones of the *Cranium*, and to moſt of the upper Jaw; and therefore obtained the Name of the *Wedge-like Bone.*

The Uſes are ſo blended with the Deſcription, as to leave nothing new to be added concerning them.

The *ſphenoid* Bone is almoſt compleat in a *Fœtus* of nine Months; only the great *Alæ* ſeparate after Maceration from the Body of the Bone.—The *Proceſſus azygos* is very large and hollow;——the internal Surface of the Body is unequal and porous;—the *Sinuſes* do not appear.

Whoever is acquainted with each Bone of the *Cranium*, can, without Difficulty, examine them as they ſtand united, ſo as to know the Shapes, Sizes, Diſtances, *&c.* of their ſeveral Parts, and the Forms, Capacities, *&c.* of the Cavities formed by them, which is of great Uſe towards underſtanding the Anatomy of the Parts contiguous to, contained within, or connected to them. Such a Review is neceſſary, after conſidering each Claſs of Bones. Thus the Orbits, Noſtrils, Mouth, Face, Head, Spine, *Thorax*, *Pelvis*, Trunk, Extremities, and Skeleton, ought likeways to be examined.

The *FACE* is the irregular Pile of Bones, compoſing the fore and under Part of the Head, which

vhich is divided, by Authors, into the Upper
nd Lower *Maxillæ* or Jaws.

The *ſuperior Maxilla* † is the common De-
ignation given to the upper immoveable Share
f the Face; though, if we would follow *Cel-
ius* (*a*), we ſhould apply the Word *Maxilla* to
he Lower Jaw only, and uſe the Name *Mala*
or this Upper Jaw. In Complaiſance to pre-
ailing Cuſtom, I ſhall, however, follow the
erms now commonly employed.—The Shape
f the ſuperior Jaw cannot eaſily be expreſſed;
or is it neceſſary, provided the Shape and Si-
uation of all the Bones which compoſe it are
eſcribed. It is bounded above by the tranſverſe
uture, behind by the Fore-part of the *ſphenoid*
one, and below by the Mouth.

The upper Jaw conſiſts of ſix Bones on each
ide, of a thirteenth Bone which has no Fel-
ow, placed in the Middle, and of ſixteen
eeth. The thirteen Bones are, two *Oſſa naſi*,
wo *Oſſa unguis*, two *Oſſa malarum*, two *Oſſa
naxillaria*, two *Oſſa palati*, two *Oſſa ſpongioſa
nferiora*, and the *Vomer*.

The *Oſſa naſi* are placed at the upper Part
f the Noſe;——the *Oſſa unguis* are at the in-
ernal *Canthi* of the Orbits; — *Oſſa malarum*
orm the Prominence of the Cheeks; — *Oſſa
naxillaria* form the Side of the Noſe, with the
vhole Lower and Fore-part of the Upper Jaw,
nd the greateſt Share of the Roof of the
Mouth; — *Oſſa palati* are ſituated at the Back-
art of the Palate, Noſtrils, and Orbit; — *Oſſa
pongioſa* are ſeen in the lower Part of the *Na-
res*;—

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† Σιαγων, γένος, Mandibula.

(*a*) Lib. 8. cap. 1.

res ; — and the *Vomer* helps to ſeparate the two Cavities.

The Bones of the *Upper Jaw* are joined t the Bones of the Scull by the *Schindyleſis* ar Sutures already deſcribed as common to th *Cranium* and *Face*, and they are connected t each other by *Gomphoſis* and fifteen Sutures.

The *Gomphoſis* only is where the Teeth ar fixed in their Sockets, and the *Schindyleſis* only where the Edges of the *Vomer* are joine to other Bones.

The Sutures are generally diſtinguiſhed b Numbers, which have been differently applie and therefore I join thoſe (*a*) who prefer th giving Names to each, which may be eaſil contrived from their Situation, or from th Bones which they connect.

The firſt is the *anterior Naſal* †, which ſtreight, and placed longitudinally in the mi dle Fore-part of the Noſe.

The ſecond and third are the *lateral Naſal* which are at each Side of the Noſe, and almo parallel to the firſt Suture.

Each of the two *Lacrymal* is almoſt ſemici cular, and is placed round the *lacrymal* Groov

The ſixth and ſeventh are the *internal Or tar* ; each of which is extended obliquely fro the Middle of the lower Side of an Orbit to th Edge of its Baſe.

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(*a*) *Vander Linden*, Medicin. phyſiolog. cap. 13. art. § 10—*Rolſinc.* Anat. lib. 2. cap. 25.——*Schenk.* Schol. pa § ult. par. 2. cap. 5.

† Naſalis Recta.

* Naſalis Obliqua.

The two *external Orbitar* are continued, each from the End of the internal Orbitar, to the Under and Fore-part of the Cheek.

The tenth is the *myſtachial*, which reaches only from the lower Part of the *Septum narium* to between the two middle *Dentes Inciſores*.

The *longitudinal Palate* † Suture ſtretches from the Middle of the foremoſt Teeth thro' the Middle of all the Palate.

The *tranſverſe Palate* one ‡ runs acroſs the Palate, nearer the Back than the Fore-part of it.

Each of the two *Palato-maxillary* is at the Back-part of the Side of each Noſtril.

The fifteenth is the *Spinous*, which is in the Middle of the lower Part of the Noſtrils. This may, perhaps, be rather thought a double *Schindyleſis*.

The Connexion of the *Oſſa ſpongioſa* to the Side of each Noſtril, is ſo much by a Membrane in young Subjects, and by Concretion or Union of Subſtance in Adults, that I did not know well how to rank it: But if any chuſes to call it a Suture, the Addition of two *tranſverſe Naſal* Sutures may be made to thoſe above named.

Theſe Sutures of the Face (formerly called *Harmoniæ*) have not ſuch conſpicuous Indentations as thoſe of the Scull have; the Bones here not having Subſtance enough for forming arge Indentations, and there being leſs Neceſity for Security againſt external Injuries, or any internal protruding Force, than in the *Cra-*

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† Laquearis, Palataria recta.

‡ Arcuata, Palatina poſtica.

nium.——Theſe Sutures often diſappear in old People, by the Bones running into each other; which can do little Prejudice, becauſe the principal Uſe of the Bones being ſo numerous here, is to allow them to be extended into a proper Form.

It is evident, from the Manner of the Conjunction of theſe Bones, that they can have no Motion, except in common with the *Cranium.*

The Purpoſes which this Pile of Bones ſerves, will be ſhewn in the Deſcription which I am to give of each.

OSSA NASI, ſo named from their Situation at the Root of the Noſe, are each of an irregular oblong ſquare Figure, being broadeſt at their lower End, narroweſt a little higher than their Middle, and becoming ſomewhat larger at the Top, where they are ragged and thickeſt, and have a Curvature forwards, that their Connexion with the *frontal* Bone might be ſtronger.——Theſe Bones are convex externally, and thereby better reſiſt any Violence from without; and they are concave internally, for enlarging the Cavity of the Noſe.

The lower Edge of theſe Bones is unequal, and is ſtretched outwards and backwards, to join the Cartilages of the Noſtrils.——Their anterior Side is thick, eſpecially above, and unequal, that their Conjunction to each other might be ſtronger; and a ſmall Riſing may be remarked on their inner Edge, where they are ſuſtained by the *Septum narium.*—Their poſterior Side, at its upper Half, has externally a Depreſſion where it is overlopped ſome Way by the *maxillary* Bones, while its lower Half covers theſe

Bones: By which Contrivance, they do not yield eaſily to Preſſure applied to their Forepart or Sides.

A ſmall Hole is frequently to be obſerved on their external Surface, into which two, three, or four Holes, which appear internally, terminate for the Tranſmiſſion of ſmall Veins, ſometimes the Holes go no further than the *Cancelli* of the Bones.

The *Naſal Bones* are firm and ſolid, with very few *Cells* or *Cancelli* in them; the thin Subſtance, of which they conſiſt, not requiring much Marrow.

They are joined above to the *frontal* Bone, by the Middle of the tranſverſe Suture;——behind, to the *maxillary* Bones, by the *lateral Naſal* Sutures;——below, to the Cartilages of the Noſe;——before, to one another, by the *anterior Naſal* Suture;——internally, to the *Septum narium*.

Theſe Bones ſerve to cover and defend the Root of the Noſe.

In an Infant the *Naſal Bones* are proportionally ſhorter, and leſs thick at their upper Part, han in an Adult, but are otherwiſe compleat.

OSSA UNGUIS, or *LACRYMALIA*, re ſo named, becauſe their Figure and Magniude are ſomething near to thoſe of a Nail of ne's Finger, and becauſe the Tears paſs upon hem into the Noſe.

Their external Surface is compoſed of two nooth Concavities and a middle Ridge.——he Depreſſion behind forms a ſmall Share of ne Orbit for the Eye-ball to move on, and the ne before is a deep perpendicular Canal, or

Foſſa, larger above than below, containing Part of the lacrymal *Sac* and *Duct*. This is the Part that ought to be pierced in the great Operation for the *Fiſtula lacrymalis*.——This *Foſſa* of the Bone is cribriform, or has a great Number of ſmall Holes through it, that the Filaments from the Membrane which lines it, inſinuating themſelves into theſe Holes, might prevent a Separation of the Membrane, and ſecure the Bone in its natural Situation.——The Ridge between theſe two Cavities of the *Os unguis*, is the proper Boundary of the Orbit at its internal *Canthus*; and beyond which Surgeons ſhould not proceed backwards in performing Operations here.——The internal or poſterior Surface of this Bone conſiſts of a Furrow in the Middle of two Convexities.

The Subſtance of the *Os unguis* is as thin as Paper, and very brittle; which is the Reaſon that thoſe Bones are often wanting in Skeletons, and need little Force to pierce them in living Subjects.

Each of theſe Bones is joined, above, to the *frontal* Bone, by Part of the *tranſverſe* Suture; ——behind, to the *Os planum* of the *Ethmoi* Bone, by the ſame Suture;—before, and below, to the *maxillary* Bone, by the *lacrymal* Suture. —Internally, the *Oſſa unguis* cover ſome of th *Sinus ethmoidales*; nay, are really continuo with the bony *Lamellæ*, which make up th Sides of theſe Cells; ſo that they are as muc Part of the *Ethmoid* Bone, as the *Oſſa plana*.

Theſe unguiform Bones compoſe the anteri internal Parts of the Orbits, lodge a Share the lacrymal Sac and Duct, and cover the *eth-moi* *moid* Cells.——Their Situation and tender Subſtance, make a raſh Operator in Danger of deſtroying a conſiderable Share of the Organ of Smelling, when he is performing the Operation of the *Fiſtula lacrymalis;* but when theſe Bones are hurt, they caſt off without much Difficulty, and conſequently the Wound is ſoon cured, unleſs the Patient labours under a general *Cacoethes*, or there is a Prediſpoſition in the Bones to *Caries;* in which Caſe, a large Train of bad Symptoms follows, or, at beſt, the Cure proves tedious.

Theſe Bones are fully formed in a new born Child.

OSSA MALARUM * was the Name given by *Celſus*, as was already remarked, to all the Upper Jaw; but is now appropriated to the prominent ſquare Bones, which form the Cheek on each Side.——Before, their Surface is convex and ſmooth; backward, it is unequal and concave, for lodging Part of the *Crotaphyte* Muſcles.

The four Angles of each of theſe Bones have een reckoned Proceſſes by ſome.——The one t the external *Canthus* of the Orbit, called the *uperior orbitar* Proceſs, is the longeſt and thickſt.——The ſecond terminates near the Middle f the lower Edge of the Orbit in a ſharp Point, nd is named the *inferior orbitar* Proceſs.——The third, placed near the lower Part of the Cheek, and thence called *maxillary*, is the horteſt, and neareſt to a right Angle.——The ourth, which is called *Zygomatic*, becauſe it is

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* Jugalia vel Zygomatica, hypopia, ſubocularia,

extended backwards to the *Zygoma* of the temporal Bone, ends in a Point, and has one Side ſtreight, and the other ſloping.——Between the two orbitar Angles there is a concave Arch, which makes about a Third of the external Circumference of the Orbit, from which a fifth Proceſs is extended backwards within the Orbit, to form near one Third of that Cavity; and hence it may be called the *internal orbitar* Proceſs.——From the lower Edge of each of the *Oſſa malarum*, which is between the maxillary and zygomatic Proceſſes, the *Maſſeter* Muſcle takes its Origin; and from the exterior Part of the *Zygomatic* Proceſs, the *Muſculus diſtortor oris* riſes; in both which Places the Surface of the Bone is rough.

On the external Surface of each Cheek-bone, one or more ſmall Holes are commonly found, for the Tranſmiſſion of ſmall Nerves or Blood-veſſels from, and ſometimes into the Orbit.——On the internal Surface are the Holes for the Paſſage of the nutritious Veſſels of theſe Bones.——A Notch on the Outſide of the *internal orbitar* Proceſs of each of theſe Bones, aſſiſts to form the great Slit common to this Bone, and to the Sphenoid, Maxillary, and Palate Bones.

The Subſtance of theſe Bones is, in Proportion to their Bulk, thick, hard, and ſolid, with ſome *Cancelli*.

Each of the *Oſſa malarum* is joined, by it ſuperior and internal orbitar Proceſſes, to th *Os frontis*, and to the orbitar Proceſs of th *ſphenoid* Bone, by the tranſverſe Suture.——B the Edge between the internal and inferior orbitar Proceſſes to the *maxillary* Bone, by the *in*

terna

ternal orbitar Suture.—By the Side between the maxillary and inferior orbitar Proceſs, again to the maxillary Bone, by the *external orbitar* Suture.——By the zygomatic Proceſs to the *Os temporum*, by the *zygomatic* Suture.

The Cheek-bones are entire, and fully oſſified in all their Parts in Infants.

OSSA MAXILLARIA SUPERIORA, are the largeſt Bones, and conſtitute the far greater Part of the Upper Jaw, which has appropriated the Name of *Maxillaria* to them. The Figure of one of them, or of the two when joined, is ſo irregular, that Words can ſcarce give an Idea of it.

The Proceſſes of each *Os maxillare* may be reckoned ſeven.——The *firſt* is the long *Naſal* one at its upper and fore Part, which is broad below, and turns ſmaller, as it riſes upwards, to make the Side of the Noſe.——At the Root of this, a tranſverſe Ridge may be obſerved within the Noſtrils, which ſupports the Forepart of the upper Edge of the *Os ſpongioſum inferius*.——The *ſecond* is produced backwards and outwards, from the Root of the Naſal Proceſs, to form the lower Side of the Orbit; and therefore may be called *orbitar*.——The Edge of this orbitar Proceſs, and the Ridge of the naſal one, which is continued from it, make a conſiderable Portion of the external Circumference of the Orbit.——From the proper orbitar Proceſs, a very rough triangular Surface is extended downwards and outwards, to be connected to the Cheek-bone; and therefore may be called the *malar* Proceſs, from the loweſt protuberant Part of which ſome Share of the maſſeter Muſcle takes its Riſe.——Behind the orbitar Proceſs, a large Tuberoſity, or Bulge of the Bone appears, which is eſteemed the *fourth* Proceſs.——On the internal Part of this we often meet with a Ridge, almoſt of the ſame Height with that in the Naſal Proceſs, which runs tranſverſely, and is covered by a ſimilar Ridge of the *palate* Bone, on which the Back-part of the upper Edge of the *Os ſpongioſum inferius* reſts.——The convex Back-part of this Tuberoſity is rough, for the Origin of Part of the external *pterygoid* Muſcle (*a*), and more internally is ſcabrous, where the Palate and ſphenoid Bones are joined to it.——That ſpongy Protuberance * at the lower Circumference of this Bone, where the Sockets for the Teeth are formed, is reckoned the *fifth.*—The *ſixth* is the horizontal Plate, which forms the greater Part of the Baſe of the Noſtrils, and Roof of the Mouth: Its upper Surface, which belongs to the Noſtrils, is very ſmooth, but the other below is arched and rough, for the ſtronger Adheſion of the Membrane of the Mouth, which is ſtretched upon it, and, in chewing, ſpeaking, *&c.* is liable to be ſeparated.—The *ſeventh* riſes like a Spine from the inner Edge of the laſt, and forms a ſmall Part of the Partition of the Noſtrils.

The Depreſſions in each *maxillary* Bone are, 1. A Sinuoſity behind the orbitar Proceſs, made by the *temporal* Muſcle. 2. A Pit immediately before the ſame Proceſs, where the Origin of the

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(*a*) *Albin*; de Oſſib. §. 79.

* φάτνια.

the *Muſculus elevator labiorum communis*, and *Elevator labii ſuperioris*, with a Branch of the fifth Pair of Nerves, are lodged ſecurely. 3. The hollow Arch of the Palate. 4. The ſemicircular great Notch, or Entry to the lower Part of the Noſtrils, betwixt the Root of the Naſal Proceſs and Spine of the palate Plate——Below this, the Fore-part of the Bone is flatted, or ſometimes hollowed by the *Muſculus depreſſor labii ſuperioris*. 5. Sockets for the Teeth †: The Number of theſe Sockets is uncertain; for the ſame Number of Teeth is not in all People, and the four backmoſt Teeth of each Jaw vary greatly in their Number of Roots; and when the Teeth of a living Perſon fall out, or are taken away, the Sockets fill up with an oſſeous Net-work, which becomes ſolid afterwards.—6. The *lacrymal Foſſa* in the *Naſal Proceſs*, which aſſiſts the *Os unguis* to form a Paſſage for the *lacrymal Duct*.——Immediately on the Out-ſide of this, there is a ſmall Depreſſion, from which the inferior or leſſer oblique Muſcle of the Eye has its Origin (*a*). 7. The Canal on the upper Part of the great Tuberoſity within the Orbit, which is almoſt a compleat Hole; in this a Branch of the ſuperior maxillary Nerve paſſes.——Beſides theſe, the ſuperior Surface of the great Bulge is concave, to receive the under Part of the Eye.——Immediately above the tranſverſe Ridge in the Naſal Proceſs, a ſmall Hollow is formed by the *Os ſpongioſum*——In ſome Subjects, the Naſal Proceſs, has a ſmall round Pit above the lacrymal Duct, where the little Tendon or Ligament of the orbicular Muſcle of the Eye-lids is inſerted. It is this Tendon, and not the Tendon of the larger oblique Muſcle of the Eye, which there is a Probability of cutting in the Operation of the *Fiſtula lacrymalis.*

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† Βόθρια, ὀλμίσκοι, Alveoli, Foſſulæ, mortariola, Fræna, Locelli, Cavæ, Præſepiola, Loculamenta.

(*a*) *Winſlow*, Expoſition Anatomique des Os Secs, §. 276.

The Holes of this Bone are two proper and two common, which are always to be found, beſides ſeveral others, whoſe Magnitude, Number, *&c.* are uncertain.——The firſt of the proper is the *external Orbitar*, immediately below the Orbit, by which the infra-orbitar Branch of the ſecond Branch of the fifth Pair of Nerves, and a ſmall Artery, come out, after having paſſed in the Canal, at the Bottom of the Orbit, deſcribed *Numb.* 7. of the Depreſſions—This Hole is often double, and that when the Nerve has happened to ſplit before it has eſcaped from the Bone.—The ſecond is the *Foramen inciſivum,* juſt behind the Fore-teeth, which, at its under Part, is one irregular Hole common to both the *maxillary* Bones when they are joined; but, as it aſcends, ſoon divides into two, three, or ſometimes more Holes; ſome of which open into each Noſtril. Through them ſmall Arteries and Veins, and a Twig of the ſecond Branch of the fifth Pair of Nerves paſs, and make a Communication between, or join the lining Coats of the Noſe and Mouth.—In ſome Subjects, *Steno*'s Duct may be traced ſome way on the Side of theſe Paſſages next to the Noſe, and ſmall Orifices may be obſerved opening into the Mouth.

The firſt common Hole is that which appears
the inner Side of the Back-part of the *Tube-*
ſity and of the Sockets of the Teeth, and is
rmed by a *Foſſa* in this Bone, and a corre-
onding one in the *Os palati:* Through it a
erve, which is a Branch of the ſecond Branch
the fifth Pair, runs to the Palate.——The
her common Hole is the great Slit in the Out
le of the Orbit deſcribed already, as the ſe-
nd common Hole of the ſphenoid Bone.

On the Naſal Proceſs often Holes may be ob-
rved for the Paſſage of Veſſels to the Sub-
ince of the Bones; and, at the Back-part of
ch Tuberoſity, ſeveral *Foramina* are placed,
r the Tranſmiſſion of Nerves to the Cavity
thin: But thoſe are uncertain.

All the Body of the *maxillary* Bone is hollow,
d leaves a large *Sinus* a-kin to the *frontal* and
henoid, which is commonly, but unjuſtly,
lled *Antrum Highmorianum**. When the *Os*
axillare is ſingle or ſeparated from all the o-
er Bones of a Skeleton, its *Antrum* appears to
ve a large Aperture into the Noſtrils; but,
a recent Subject, it is ſo covered at its Back-
rt, by the *palate* Bone; in the Middle, by the
ſpongioſum inferius; before, by a ſtrong
embrane, that one, or ſometimes two Holes
rce larger than a Crow-quill, are only left at
upper Part; which, after a ſhort winding
ogreſs, open into the Noſtrils between the
Oſſa ſpongioſa.—At the Bottom of this Ca-
y, we may often obſerve ſome Protuberances,
which the ſmall Points of the Roots of the
Teeth

Genæ.

Teeth are contained (*a*).—This Cavern, an the Sockets of the Teeth are often divided by the Interpoſition only of a very thin bony Plate which is liable to be eroded by acrid Matte collected in the *Antrum*, or to be broke in drawing a Tooth (*b*). The Symptoms of a Collection of Matter here naturally lead us to th Practice of pulling out the Teeth, and piercin through this Plate into the *Antrum*, to procure an Evacuation of the collected Matter; b which conſiderable Service is frequently done (*c*)

The *maxillary Sinuſes* have the ſame Uſes a the *frontal* and *ſphenoidal*; and the Situatio of the *Sinuſes* is ſuch, that the Liquor drillin from them, from the Cells of the Ethmoid an Palate Bones, and from the lacrymal Duct may always moiſten all the Parts of the Membrane of the *Nares* in the different Situatio which the Head is in.

Though the Membranes, which line th *frontal*, *ſphenoidal*, and *maxillary Sinuſes*, a Continuations of the one which covers th Bones within the Noſe; yet they are mu thinner than it is, and have ſo much ſmall Veſſels, that the Injection which makes th Membrane of the Noſe red all over, fills on ſome few Veſſels of the *maxillary Sinuſes*, a ſcarce is obſerved in the *frontal* and *ſphenoid* Are not the larger Veſſels intended for a mo plentiful Secretion of a viſcid Liquor to defe the Membrane from the Effects of the *Per*

(*a*) *Highmore*, Diſquiſ. Anat. lib. 3. part 2. cap. 1.

(*b*) *Highmore*, ibid.

(*c*) *Cowper* in *Drake*'s Anthropol. Book 3. chap. 10.— Medical Eſſays and Obſerv. Vol. V. Art. 30.

us, which is conſtantly through the Noſe? Are
not the Membranes which have the ſmalleſt
Veſſels, *cæteris paribus*, the moſt ſenſible? Are
ot many Phænomena of Smelling, Inflamma-
ions of theſe Parts, *Megrim*, *Polypi*, &c. de-
ending on this Structure of theſe Membranes?

The Subſtance of the *Oſſa maxillaria* is com-
act and firm, except at the inferior Proceſs,
n which the Teeth are lodged, where it is very
pongy.

The *maxillary* Bones are joined above by the
pper Ends of their naſal Proceſſes to the *Os*
rontis, by the tranſverſe Suture;—at the Sides
f theſe Proceſſes, to the *Oſſa unguis*, by the
acrymal Sutures;—to the *naſal* Bones, by the
ateral Naſal Sutures;—by their orbitar Proceſ-
es, to the *Cheek* Bones, by the *external orbitar*
utures;—by the internal Sides of the internal
rbitar Proceſſes, to the *Oſſa plana*, by Part of
he *ethmoidal* Suture;——by the Back-part of
he Tuberoſities, to the *palate* Bones, by the
uturæ palato-maxillares;——by the poſterior
dges of their palatine *Lamellæ*, to the *Oſſa*
alati, by the *tranſverſe* Palate Suture;——by
heir Naſal *Spines*, to the *Vomer*, by the *ſpi-*
ous Suture;——by their Sockets, to the Teeth,
y *Gomphoſis*;—by the internal Edge of the
alate Plate, to one another, by the *longitudi-*
al Palate Suture; on the Upper and Fore-part
f which a Furrow is left for receiving the
artilage which forms the Partition of the No-
rils;—between the Fore-part of the Noſtrils
nd Mouth, to each other, by the *myſtachial* Su-
ure;——ſometimes they are connected to the

Oſſa ſpongioſa inferiora, by a plain Concretion or Union of Subſtance.

Theſe Bones form the greater Part of the Noſe and of the Roof of the Mouth, and a conſiderable Share of the Orbit. They contain ſixteen Teeth, give Riſe to Muſcles, Tranſmiſſion to Nerves, *&c.* as mentioned in the Deſcription of their ſeveral Parts.

In each of the *maxillary* Bones, of a new-born Child, the external orbitar Proceſs is hollow with remarkable Holes in it;——there are five Sockets for the Teeth, of which the two poſterior are very large, and, when divided by a ſecond croſs Partition, make the Number of Sockets ſix (*a*).——The Palate Plate is cribriform about the Middle.——The great Tuberoſity is not formed;——inſtead of the *Antrum*, there is only an oblong Depreſſion at the Side of the Noſtrils.

OSSA PALATI are commonly deſcribed as two ſmall ſquare Bones, at the Back-part of the Palate or Roof of the Mouth, though they are of much greater Extent, being continued up the Back-part of the Noſtrils to the Orbit (*b*). Each Palate-bone may therefore be divided into four Parts, the Palate Square-bone, the pterygoid Proceſs, naſal *Lamella*, and orbitar Proceſs.

The Square-bone is unequally concave, for enlarging both the Mouth and Cavity of the

Noſe.

(*a*) *Albin.* Oſteogen. Tab. 5. Fig. 45. — Ungebav. d Dentit. ſecund. jun, § 1.

(*b*) *Euſtach.* Tab. 47. Fig. 1. 3, 6, 7, 8.——*Vidus Vidius* de Anat. lib. 2. cap. 2. Explicat. Tab. 6. Fig. 19.—*Winſlow* Memoires de l'Acad. des Sciences, 1720.

Noſe. The upper Part of its internal Edge riſes into a Spine, after the ſame Manner as the Palate Plate of the *maxillary* Bone does, to be joined with the *Vomer*.—Its anterior Edge is unequally ragged, for its firmer Connexion with the Palate Proceſs of the *Os maxillare*.—The internal Edge is thicker than the reſt, and of an unequal Surface, for its Conjunction with its Fellow of the other Side.——Behind, this Bone is ſomewhat in Form of a Creſcent, and thick, for the firm Connexion of the *Velum pendulum palati*; the internal Point being produced backwards, to afford Origin to the *palato-ſtaphylinus* or *azygos* Muſcle.——This Square-bone is well diſtinguiſhed from the *pterygoid* Proceſs by a perpendicular *Foſſa*, which, applied to ſuch another in the *maxillary* Bone, forms a Paſſage for the palatine Branch of the fifth Pair of Nerves; and by another ſmall Hole behind this, through which a Twig of the ſame Nerve paſſes.

The *pterygoid* Proceſs is ſomewhat triangular, having a broad Baſe, and ending ſmaller above. The Back-part of this Proceſs has three *Foſſæ* formed in it; the two lateral receive the Ends of the two Plates of the ſphenoid Bone, that are commonly compared to a Bat's Wing; the middle *Foſſa* makes up Part of what is commonly called the *Foſſa pterygoidea*; the Fore-ſide of this palatine pterygoid Proceſs is an irregular Concave, where it receives the Back-part of the great *Tuberoſity* of the *maxillary* Bone.——Frequently ſeveral ſmall Holes may be obſerved in this triangular Proceſs, particularly one near the Middle of its Baſe, which a little above

commu-

communicates with the common and proper Holes of this Bone already taken Notice of.

The *Naſal Lamella* of this Bone is extremely thin and brittle, and riſes upwards from the upper Side of the external Edge of the Square-bone, and from the narrow Extremity of the *pterygoid* Proceſs; where it is ſo weak, and, at the ſame Time, ſo firmly fixed to the *maxillary* Bone, as to be very liable to be broken, in ſeparating the Bones.——From the Part where this Plate riſes, it runs up broad on the Inſide of the *Tuberoſity* of the *maxillary* Bone, to form a conſiderable Share of the Sides of the *maxillary Sinus*, and to cloſe up the Space between the *Sphenoid* and the great Bulge of the maxillary Bone, where there would otherwiſe be a large Slit opening into the Noſtrils (*a*).—From the middle internal Side of this thin Plate, a croſs Ridge placed on ſuch another of the maxillary Bone is extended; on it, the Back-part of the *Os ſpongioſum inferius* reſts:—Along the Outſide of this Plate, the perpendicular *Foſſa* made by the Palate Nerve is obſervable.

At the upper Part of this Naſal Plate, the Palate Bone divides into two Proceſſes, which I already named *orbitar*;——between which and the Body of the *ſphenoid* Bone, that Hole is formed, which I mentioned as the laſt of the Holes common to the *ſphenoid* Bone.——Sometimes this Hole is wholly formed in the *Os palati*, by a croſs Plate going from the one orbitar Proceſs to the other. A Nerve, Artery and Vein

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(*a*) *Albin.* de Oſſib. § 88.

Vein belonging to the Noſtrils paſs here.—The anterior of the two orbitar Proceſſes is the largeſt, and has its Fore-part contiguous to the Back-part of the *maxillary Sinus*, and its upper Surface appears in the Bottom of the Orbit, behind the Back-part of th. *Os maxillare* and *planum*.—It has Cells behind reſembling thoſe of he *ethmoid* Bone, to which it is contiguous; it s placed on the Aperture of the *Sinus ſphenoidalis*, ſo as to leave only a round Hole at its upper Fore-part.—The other Part of the orbitar Proceſs is extended along the internal Side of he upper Back-part of the maxillary *Tuberoſity*, o the Baſe of the *ſphenoid* Bone, between the Root of the *Proceſſus azygos* and the pterygoid Proceſs.

The Palate ſquare Part of this Palate Bone, nd its pterygoid Proceſs, are firm and ſtrong, vith ſome *Cancelli*; but the Naſal Plate and orbitar Proceſſes are very thin and brittle.

The Palate Bones are joined to the *maxillar*, by the Fore-edge of the Palate Square-bone, y the *tranſverſe Palate* Suture:—By their thin Naſal Plates, and Part of their orbitar Proceſſes, the ſame Bones, by the *Palato-maxillares* Sutures:—By their *pterygoid* Proceſſes, and Back-part of the *Naſal Plates*, to the *Alæ veſpertilionum*, by the *ſphenoid* Suture:——By the tranſverſe Ridges of the Naſal Plates, to the *Oſſa ſpongioſa inferiora*, by Contact; hence frequently there is an intimate Union of the Subſtance f theſe Bones in old Sculls:——By the orbitar roceſſes, to the *Oſſa plana* and *Cellulæ ethmoidæ*, by the *ethmoid* Suture:——To the Body the *ſphenoid* Bone, by the *ſphenoid* Suture:—

By the internal Edge of the Square-bones to each other, by the *longitudinal* Palate Suture; and by their Naſal Spines to the *Vomer*, by the *ſpinous* Suture.

The Palate Bones form Part of the Palate, Noſtrils, Orbits, and *Foſſæ pterygoideæ*, and they cover Part of the *Sinus maxillares*, *ſphenoidales* and *ethmoidei*.

Theſe Bones are very complete in a new-born Infant, the Naſal Plates being then thicker and ſtronger than in Adults; but the orbitar Proceſſes have not the Cells which appear in the Bones of Adults.

When we are acquainted with the Hiſtory of theſe Bones, the Reaſon is evident, why the Eyes are ſo much affected in Ulcers of the Palate, as to be often attended with Blindneſs, which frequently happens in an ill-managed *Lues Venerea;* or why, on the other Hand, the Palate ſuffers from an *Ægylops* (*a*).

OSSA TURBINATA, or *ſpongioſa inferiora*, reſemble the ſuperior *Oſſa ſpongioſa* in Shape and Subſtance, but have their anterior and upper Edges contiguous to the tranſverſe Ridges of the Naſal Proceſſes of the *maxillary* and *Palate Bones*.——From their upper ſtreight Edge, two ſmall Proceſſes ſtand out: The poſterior, which is the broadeſt, deſcends to cover ſome of the *Antrum Highmorianum;* the anterior riſes up to join the *Os unguis*, and to make Part of the *lacrymal Duct*.

Below the ſpongy Bones already mentioned, there are ſometimes two others, one in each Noſtril,

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(*a*) *Hoffman*. in Ephemerid, German. Cent. 1. and 2. obſerv. 135.

Noſtril, which ſeem to be a Production of the Sides of the maxillary *Sinus* turned downwards (*a*). When this third Sort of ſpongy Bones is found, the middle one of the three in each Noſtril is the largeſt, and the loweſt is the ſmalleſt.——Beſides all theſe, there are often ſeveral other ſmall Bones ſtanding out into the Noſtrils, that, from their Shape, might alſo deſerve the Name of *Turbinata*, but are uncertain in their Bulk, Situation, and Number (*b*).

The Names of theſe Bones ſufficiently declare their ſpongy Subſtance, which has no firm external Plate covering it.

They are joined to the *Oſſa maxillaria, palati* and *unguis* in old Subjects, by a firm Union of Subſtance; and as this happens alſo frequently in People of no great Age, ſome (*c*) are of Opinion, that they ſhould be eſteemed Part of the Palate-bones; others (*d*) think, that ſince heir upper Edge is continued by a Plate to a Part of the *Os ethmoides*, they ought to be eſteemed to be a Part of this Bone.

Their Uſe is, to ſtraiten the Noſtrils, to afford a large Surface for extending the Organ of Smelling, to cover Part of the *Antra maxillaria*, and to aſſiſt in forming the Under-part of the lacrymal Ducts, the Orifices of which into the Noſe are concealed by theſe Bones.

The *Oſſa turbinata* are nearly complete in a new-born Infant.

VOMER,

(*a*) *Cowper* in *Drake*'s Anthropolog. Book 3. Chap. 10.
(*b*) *Santorin*, Obſervat. Anatomic. cap. 5. § 9.
(*c*) *Id.* ibid. cap. 5. § 7.
(*d*) *Hunauld.* in Memoires de l'Acad. des Sciences, 1730.

VOMER, or Bone reſembling a Plough-ſhare, is the thirteenth of the Upper Jaw, without a Fellow, forming the Lower and Back-parts of the Partition of the Noſe (*a*).

The Figure of this Bone is an irregular Rhomboid.—Its Sides are flat and ſmooth.——Its poſterior Edge appears in an oblique Direction at the Back-part of the Noſtrils.——The upper one is firmly united to the Baſe of the *ſphenoid* Bone, and to the Naſal Plate of the *ethmoid;* and, when it can be got ſeparated, is hollow, for receiving the *Proceſſus azygos* of the *Sphenoid.*——The anterior Edge has a long Furrow in it, where the middle Cartilage of the Noſe enters.——The lower Edge is firmly united to the Naſal Spines of the maxillary and Palate Bones.——Theſe Edges of this Bone are much thicker than its Middle, which is as thin as the fineſt Paper; by which, and the firm Union or Connexion this Bone has above and below, it can very ſeldom be ſeparated entire in Adults: But, in a Child, it is much more eaſily ſeparated entire; wherefore I ſhall examine all its Parts of ſuch a Subject.

Its Situation is not always perpendicular, but often inclined and bended to one Side, as well as the Naſal Plate of the *ethmoid* Bone.

The *Vomer* is convex at its upper Part, and then is ſtreight, as it is extended downwards and forwards where it is compoſed of two Plates; the Edges of which have a great Number of ſmall Proceſſes, diſpoſed ſomewhat like the Teeth of a Saw, but more irregularly, and ſeveral

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(*a*) *Columb.* de re Anat. lib. 1. cap. 8.—*Fallop.* Obſervat. Anatom.

veral of them are reflected back. Between
heſe Plates a deep *Foſſa* is left, which, ſo far
s the Top of the Curvature, is wide, and has
trong Sides, for receiving the *Proceſſus azygos*
f the *ſphenoid* Bone. Beyond the Arch for-
vards, the *Foſſa* is narrower and ſhallower gra-
ually to the Point of the Bone, receiving for
ome Way the Naſal *Lamella ethmoidea;* which,
fter the Oſſification is compleat, is ſo cloſely
nited to the *Vomer* by the little Proceſſes pierc-
ng into its Subſtance, as to prevent any Sepa-
ation; on which account it has been eſteemed
y ſome (*a*) a Part of the ethmoid Bone. The
iddle Cartilage of the Noſe fills up what re-
ains of the *Foſſa* at its Fore-part.——The
oſterior Edge of the *Vomer*, which appears
bove the Back-part of the Palate-bones, is
roader above; but as it deſcends forwards, be-
omes thinner, though it is ſtill ſolid and firm.
-The lower Edge of this Bone, which reſts on
e Naſal Spine of the *Palate* and *maxillary*
ones, has a little Furrow on each Side of a
nall middle Ridge, anſwering to the Spines of
e Bones of different Sides, and the Interſtice
etween them. This Edge, and the upper one
eet in the pointed Fore-end of this Bone.

The Body of the *Vomer* has a ſmooth Sur-
ce, and ſolid, but thin Subſtance; and towards
s Sides, where it is thickeſt, ſome *Cancelli* may
e obſerved, when the Bone is broken.

It is joined above to the *ſphenoid* and *ethmoid*
ones, and to the middle Cartilage of the Noſe,
y Schindyleſis;——below, to the maxillary and
alate Bones, by the *ſpinous* Suture.

The

(*a*) *Lieutaud.* Eſſais Anatomiques 1. ſect. l'Os ethmoide.

The *Vomer* divides the Noſtrils, enlarges the Organ of Smelling, by allowing Place for expanding the Membrane of the Noſe on its Sides, and ſuſtains the Palate Plates of the *maxillary* and *palate* Bones, which otherwiſe might be in Hazard of being preſſed into the Noſtrils; while the *Vomer* is ſecured from ſhuffling to one Side or other by the double *Schindyleſis*, by which it is joined to the Bones above and below.

Theſe then are all the Bones which compoſe the Upper Jaw, except the Teeth, which are ſo much a-kin to thoſe of the lower Jaw, that I chuſe to make one Deſcription ſerve for both, in which the Differences obſervable in them ſhall be remarked, after the ſecond Part of the Face, the Lower Jaw, is examined; becauſe the Structure of the Teeth cannot be well underſtood, until the Caſe in which they are ſet is explained.

MAXILLA INFERIOR *, the Lower Jaw, conſiſts only of one moveable Bone, and ſixteen Teeth incaſed into it.

This Bone, which is ſomewhat of the Figure of the *Greek* Letter *υ*, is ſituated at the lower Part of the Face, ſo as its convex middle Part is forwards, and its Legs are ſtretched back. It is commonly divided into the Chin, Sides, and Proceſſes.—The *Chin* is the middle Forepart, the Extent of which to each Side is marked on the external Surface by the Holes obſervable there, and internally by the Beginning of an oblique Ridge.—Beyond theſe the *Sides* appear;

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* Τὲνος, σιάγων, Mandibula, facies.

ear, and are continued till the Bone, by bend-
ig upwards, begins to form the Proceſſes.

On the Fore-part of the *Chin*, a tranſverſe
idge appears in the Middle, on each Side of
hich the *Muſculi quadrati*, or *Depreſſores labii*
ferioris, and the *levatores labii inferioris*,
epreſs the Bone: And below theſe Prints,
ſmall Riſing may be obſerved, where the
epreſſores commence. —— On the Back-part
f the Chin, ſometimes three, always two,
nall Protuberances appear in the Middle. To
ne uppermoſt, when it is ſeen, the *Fræmum* of
ne Tongue is connected. From the middle
ne, the *Muſculi genioglоſſi* riſe; and from the
weſt, the *Geniohyoidei* have their Origin. Be-
w the laſt, we ſee two rough Sinuoſities form-
d by the *digaſtric* Muſcles.

At the Lower and Fore-part of the external
urface of each Side of the Lower Jaw, a ſmall
minence may be obſerved, where the *Depreſ-*
r labiorum communis riſes. Near the upper
dge of the Side a Ridge runs Length-ways,
which the under Part of the *Muſculus Bucci-*
itor is connected.——Internally, towards the
pper Edge of each Side, another Ridge appears
om which the *Mylohyoidei* have their Origin,
id to which the internal Membrane of the
ums adheres.

In the upper Edge of both Chin and Sides
e a great many deep Pits or Sockets, for re-
iving the Roots of the Teeth. The Number
id Magnitude of theſe Sockets are various, be-
uſe of the different Number, as well of the
eeth themſelves, as of their Roots, in diffe-
nt People. Theſe Sockets in this Lower Jaw,

as well as in the Upper one, are leſs deep as old Age comes on; when freed from the Teeth by any Means, they are ſome time after filled up with an oſſeous Net-work, which at laſt becomes entirely ſolid, and as ſmooth as any other Part of the Bone; ſo that in a great many old Jaws one cannot obſerve a Veſtige of the Sockets: But then the Jaw becomes leſs, and much narrower (*a*).—Hence we may know why the Chin and Noſe of edentulous People are much nearer than before the Teeth were loſt; while their Lips either fall in towards the Mouth, or ſtand prominent forwards.—When new Teeth are protruded, new Sockets are formed (*b*).—The lower Edge of the Chin and Sides is ſmooth and equal, and is commonly called the *Baſe* of the Lower Jaw.—The Ends of the Baſe, where the Jaw turns upwards, are called its *Angles*; the external Surface of each of which has ſeveral Inequalities upon it, where the *Maſſeter* Muſcle is inſerted; as the internal Surface alſo has, where the *Pterygoideus internus* is inſerted, and a Ligament extended from the *ſtyloid* Proceſs of the temporal Bone is fixed.

The Proceſſes are two on each Side.——The anterior ſharp thin *coronoid* ones have the *crotaphite* Muſcles inſerted into them——The poſterior Proceſſes or *Condyles* * terminate in an oblong ſmooth Head, ſupported by a *Cervix*. The Heads whoſe greateſt length is tranſverſe, and whoſe Convexity is turned forwards, are tipped with a Cartilage, as the articulated Part

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(*a*) *Veſal.* Anat. lib. 1. cap. 10.

(*b*) *Fallop.* Obſerv. Anat.

* Articulatorii.

of all other moved Bones are.—The Fore-part of the Root and Neck of theſe *condyloid* Proceſſes are a little hollow and rough, where the external *Pterygoid* Muſcles are inſerted.

The Holes of the Lower Jaw are two on each Side; one at the Root of the Proceſſes internally, where a large Branch of the third Branch of the fifth Pair of Nerves enters with an Artery, and a Vein returns. A ſmall ſharp Proceſs frequently jutts out backwards from the Edge at the Fore-part of this Hole, to which a Ligament extended from the temporal Bone is fixed (*a*), which ſaves the Nerve and Veſſels from being too much preſſed by the *pterygoid* Muſcles.—From the lower Side of this Hole, either a ſmall ſuperficial Canal or a Furrow deſcends, where a Branch of the Nerve is lodged, in its Way to the *Mylo-hyoideus* Muſcle and ſublingual Gland (*b*).—The other Hole is external, at the Confines of the Chin, where Branches of the Nerve and Veſſels come out.—The Canal betwixt theſe two Holes is formed in the middle of the Subſtance of the Bone, and is pierced by a great Number of ſmall Holes by which the Nerves and Blood-veſſels of the *Cancelli* and Teeth paſs. This Canal is continued a little further than the external Hole at the Chin.—On account of the Veſſels and Nerves in the Lower Jaw, Fractures of it may be attended with dangerous Symptoms.

The Surface of the lower Jaw is hard and firm, except at the ſpongy Sockets, where however

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(*a*) *Weitbrecht*, Syndeſmolog. Fig. 32. 1.

(*b*) *Palfyn*. Anat. Chirur. traite 5. chap. 6.

however it is ſtronger than the Upper Jaw.— Its internal Subſtance is cellular, without any ſolid Partition between the *Cancelli* in its Middle.——At the Baſe, eſpecially of the Chin, where this Bone is moſt expoſed to Injuries, the ſolid Sides of it are thick, compact, and hard.

The lower Jaw generally receives the Roots of ſixteen Teeth into its Sockets, by *Gomphoſis*; and its *condyloid* Proceſſes, covered with Cartilage, are articulated with the *temporal* Bones, in a Manner that is not commonly deſcribed right: For, as was already mentioned in the Deſcription of the temporal Bones, not only the Fore-part of the Cavity between the *zygomatic*, *auditory* and *vaginal* Proceſſes, but alſo the adjoining Tubercle at the Root of the *zygomatic* Proceſs of each *Os temporum* is covered with a ſmooth Cartilage, for this Articulation.——Here alſo an intermediate moveable Cartilage is placed, which being thin in the Middle, and thick at the Edges, is concave on both Sides; and is connected ſo firmly by Ligaments to each *Condyle*, as to follow the Motions of the *Condyle*; and ſo looſely to the *temporal* Bone, as readily to change its Situation from the Cavity to the Tubercle, and to return again; while the common Ligament of the Articulation affords Space enough for ſuch a Change of Place backwards and forwards; but, like other Ligaments of the Joints by *Ginglimus*, is ſtrong and ſhort at the Sides, to confine the lateral Motions.

When therefore the Teeth of both Jaws coincide, the *Condyles* are lodged ſecurely in the temporal Cavities, but their Motions to either Side muſt be confined both by the Firmneſs of the Ligaments, and the riſing Brims which are on each Side of the Cavities. —— When the Jaw is brought directly forwards, the Condyles and intermediate Cartilages deſcend and advance forwards upon the Tubercles. —— In this Situation the lateral Motions are a little more free than in the former one, from the want of riſing Brims to ſtop the Condyles. —— When the Fore-teeth of the Lower Jaw are moved forwards, and to a Side, the Condyle of the oppoſite Side is either advanced from the Cavity to the Tubercle, while the Condyle of the ſame Side remains in the Cavity; or if both Condyles are on the Tubercles, when the Jaw is moved obliquely to a Side, the Condyle of the Side to which the Motion is made, ſlides back from the Tubercle to the Cavity. — When the Mouth is opened by the Deſcent of the Lower Jaw, the Fore-part of it, where the *depreſſing* Muſcles are fixed, is drawn backwards, as well as downwards, while Reſiſtance is made to the Angles moving backwards by the *Maſſeter* and *internal pterygoid* Muſcles, and, at the ſame time, the *external Pterygoid* draw the Condyles and their moveable Cartilages forwards; and therefore, when the Mouth is opened, the Condyles are carried forwards upon the Tubercles, and the Axis of Motion of the Bone is a little above its Angles. But in this Situation there is leſs Reſiſtance, than in any other, to the Condyles luxating forwards; a Diſeaſe which ſeldom happens, except when People are gaping too wide; and therefore the common Practice of Nurſes, who ſupport the Jaw of Infants when they are yawning, is reaſonable.——In chewing there is a Succeſſion of the Motions above deſcribed. *(a)*.

Here a general Remark may be made, That where-ever moveable Cartilages are found in Joints, either the articulated Bones are of ſuch a Figure, or ſo joined and fixed by their Ligaments, that little Motion would be allowed without ſuch Cartilages; or elſe ſome Motions are neceſſary to the right Uſe of the Member, which the Form of the Articulation would not otherwiſe admit of. This will more fully appear after the other Joints with ſuch Cartilages are deſcribed.

In a Child born to the full Time the lower Jaw is compoſed of two Bones, connected by a thin Cartilage in the Middle of the Chin, which gradually oſſifies, and the two Bones intimately unite.——In each of theſe Bones there are five or ſix Sockets for Teeth as in the Upper Jaw.

After I have thus deſcribed the Incaſement of the Teeth, the Inſertion of ſo many Muſcles of the Tongue, and of the *Os hyoides*, the Connexion of the Membrane of the Tongue to the maxillary Bone, and the Motions of this Bone; it is eaſy to ſee, that the Lower Jaw muſt be a principal Inſtrument in Munducation, Deglutition, and Speech.

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(a) For a more full Account of this Articulation, vid. *Edinburgh* Medical Eſſays and Obſerv. Vol. 1. Art. 11. & Vol. 3. Art. 13.—Memoires de l'Acad. des Sciences, 1744.

The *TEETH* are the hard white Bodies placed in the Sockets of both Jaws. Their Number is generally ſixteen above, and as many below; though ſome People have more, others have fewer.

The broad thick Part of each Tooth which appears without the Socket, is the *Baſe* or Body *. ——The ſmaller Proceſſes ſunk into the *Maxillæ*, are the *Roots* or *Fangs*, which become gradually ſmaller towards the End fartheſt from the Baſe, or are nearly conical, by which the Surface of their Sides divide the Preſſure made on the Baſes, to prevent the ſoft Parts, which are at the ſmall Points of the Sockets, to be hurt by ſuch Preſſure.——At the Place where the Baſe ends, and the Roots begin, there is generally a ſmall circular Depreſſion, which ſome call the *Neck* or *Collar*.

Without the Gums the Teeth are covered with no Membrane, and they are ſaid to have no proper *Perioſteum* within the Sockets; but that is ſupplied by the reflected Membrane of the Gums; which, after a good Injection, may be evidently ſeen in a young Subject, with the Veſſels from it penetrating into the Subſtance of the Teeth; and it may be diſcovered in any Tooth recently pulled, by macerating it in Water (*a*). The Adheſion of this Membrane to theſe Roots is ſtrengthned by the ſmall Furrows obſervable on them.

Each Tooth is compoſed of its *Cortex*, or *Enamel*, and an internal bony Subſtance. The

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* Corona.

(*a*) *Cowper*, Anatom. Explicat. Tab. 92. Fig. 7. lit. E.

Cortex has no Cavity, or Place for Marrow; and is ſo ſolid and hard, that Saws or Files can with Difficulty make Impreſſion on it. It is thickeſt upon the Baſe, and gradually, as the Roots turn ſmaller, becomes thinner, but not proportionally to the Difference of the Size of the Baſe and Roots.——The Fibres of this Enamel are all perpendicular to the internal Subſtance, and are ſtreight on the Baſe, but at the Sides are arched with the convex Part towards the Roots (*a*); which makes the Teeth reſiſt the Compreſſion of any hard Body between the Jaws, with leſs Danger of breaking theſe Fibres, than if they had been ſituated tranſverſely. The ſpongy Sockets in which the Teeth are placed, likewiſe ſerve better to prevent ſuch an Injury, than a more ſolid Baſe would have done.——Notwithſtanding the great Hardneſs of this *Cortex*, it is waſted by Manducation. Hence the ſharp Edges of ſome Teeth are blunted, and made broad, while the rough Surfaces of others are made ſmooth and flat, as People advance in Life.

The bony Part of the Teeth has its Fibres running ſtreight, according to the Length of the Teeth. When it is expoſed to the Air, by the breaking or falling off of the hard *Cortex*, it ſoon corrupts. And thence carious Teeth are often all hollow within, when a very ſmall Hole appears only externally.

The Teeth have Canals formed in their Middle, wherein their Nerves and Blood-veſſels are lodged; which they certainly need, being conſtantly

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(*a*) *Havers*'s Oſteolog. nov. Diſc. 1.

ſtantly waſted by the Attrition they are ſubjected to in Manducation, and for their further Growth, not only after they firſt appear, but even in Adults; as is evident when a Tooth is taken out: For then the oppoſite one becomes longer, and theſe on each Side of the empty Socket turn broader; ſo that when the Jaws are brought together, it is ſcarce obſervable where the Tooth is wanting (*a*).

The Veſſels are eaſily traced ſo long as they are in the large Canal, but can ſcarce be obſerved in their Diſtribution from that to the Subſtance of the Teeth of Adults. *Ruyſch* (*b*) however affirms, that after Injection he could trace the Arteries into the hardeſt Part of the Teeth: And *Lewenhoek* (*c*) ſuſpected the Fibres of the *Cortex* to be Veſſels. In Children I have frequently injected the Veſſels of the Teeth as far as their Baſe: And in ſuch as are not entirely oſſified, one can with a lucky Injection fill ſo many Veſſels, as to make both the Outſide and Inſide of the cortical Part appear perfectly red. ——This plentiful Supply of Veſſels muſt expoſe the Teeth to the ſame Diſorders that attack other vaſcular Parts; and ſuch Teeth as have the greateſt Number of Veſſels, muſt have the moſt numerous Chances of being ſeized with theſe Diſeaſes.

Every Root of each Tooth has ſuch a diſtinct Canal, with Veſſels and Nerves in it. Theſe Canals in the Teeth with more than one Root, come nearer each other, as they approach the Baſe

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(*a*) *Ingraſ.* de Tumor, cap. 1. p. 24. 25, 26.

(*b*) Theſaur. 10. num. 27.

(*c*) Arcan. Natur. Continuat. Epiſt. p. 3.

Baſe of the Tooth; and at laſt are only ſeparated by very thin Plates, which being generally incompleat, allow a Communication of all the Canals; and frequently one common Cavity only appears within the Baſe, in which a pulpy Subſtance compoſed of Nerves and Veſſels is lodged. The Condition therefore of the Nerves here, bears a ſtrong Analogy to that of the cutaneous Nerves which ſerve for the Senſation of Touching.

The Entry of the Canals for theſe Veſſels is a ſmall Hole placed a little to a Side of the extreme Point of each Root; ſometimes, eſpecially in old People, this Hole is entirely cloſed up, and conſequently the Nerves and Blood-veſſels are deſtroyed (*a*).

The Teeth are ſeen for a conſiderable Time in Form of *Mucus* contained in a Membrane; afterwards a thin cortical Plate, and ſome few oſſeous Layers appear within the Membrane, with a large Cavity filled with *Mucus* in the Middle; and gradually this exterior Shell turns thicker, the Cavity decreaſes, the Quantity of *Mucus* is leſſened, and this Induration proceeds, till all the Body is formed; from which the Roots are afterwards produced.

In young Subjects, different *Stamina* or Rudiments of Teeth are to be obſerved. Thoſe next the Gums hinder ordinarily the deeper-ſeated ones from making their Way out, while theſe prevent the former from ſending out Roots, or from entering deep into the bony Sockets of the Jaws; by which they come to be leſs fixed.

Children

(*a*) *De la Hire* Hiſtoire de l'Acad des Sciences, 1699.

Children are ſeldom born with Teeth; but at two Years of Age they have twenty; and their Number does not increaſe till they are about ſeven Years old, when the Teeth that firſt made their Way through the Gums, are thruſt out by others that have been formed deeper in the Jaw, and ſome more of the Teeth begin to diſcover themſelves farther back in the Mouth. About fourteen Years of Age, ſome more of the firſt Crop are ſhed, and the Number is increaſed.——This Shedding of the Teeth is of good Uſe; for if the firſt had remained, they would have ſtood at a great Diſtance one from another; becauſe the Teeth are too hard in their outer Cruſt, to increaſe ſo faſt as the Jaws do. Whereas both the ſecond Layer, and the Teeth that come out late, meeting, while they are ſoft, with a conſiderable Reſiſtance to their Growth in Length, from thoſe ſituated upon them, neceſſarily come out broad, and fit to make that cloſe Guard to the Mouth †, which they now form.

The Teeth are joined to the Sockets by *Gomphoſis*, and the Gums contribute to fix them there; as is evident by the Teeth falling out when the Gums are any Way deſtroyed, or made too ſpongy; as in the *Scurvy* or *Salivations*: Whence ſome (*a*) claſs this Articulation with the *Syſſarcoſis*.

The Uſes of the Teeth are to maſticate our Aliment, and to aſſiſt us in the Pronunciation of ſeveral Letters.

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† φραγμὸς.

(*a*) *Drake*'s Anthropolog. Book 4. Chap. 3.

Though the Teeth ſo far agree in their Structure, yet, becauſe of ſome Things wherein they differ, they are generally divided into three Claſſes, *viz. Inciſores*, *Canini*, and *Molares*.

The *Inciſores* * are the four Fore-teeth in each Jaw, receiving their Name from their Office of cutting our Aliment; for which they are excellently adapted, being each formed into a ſharp-cutting Edge at their *Baſe*, by their Fore-ſide turning inwards there, while they are ſloped down and hollowed behind †; ſo that they have the Form of Wedges; and therefore their Power of acting muſt be conſiderably increaſed.——Seeing in the Action of the *Inciſores*, a perpendicular Compreſſion is only neceſſary, without any lateral Motion, they are not ſo firmly fixed in their Sockets as the other Teeth are, each having only one ſhort Root, but that is broader from before backwards, than to either Side, to have the greateſt Strength where it is expoſed to the ſtrongeſt Force applied to it (*a*).

The *Inciſores* of the Upper Jaw, eſpecially the two middle ones ‡, are broader and longer generally than thoſe of the Under Jaw.

In a new-born Infant, the outer Shell of the Body of theſe Teeth is only hardned.——Afterwards, when the *Stamina* of two Sets are formed, each has its own Socket, thoſe neareſt to the Gums being placed more forward, and the others are lodged farther back within the Jaw-bones.

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* Γελασῖνοι, τομικοὶ, διχαστῆρες, κτένες, τομεῖς, πρωσθιοι ὀξεῖς, Riſorii, quaterii, primi, primores, anteriores, acuti.

† Ὀλμίσκος.

(*a*) Lettre ſur l'Oſteologie aſcribed to DuVerney.

‡ Duales.

Canini ‖, from the Reſemblance to Dogs Tuſks, are one on each Side of the *Inciſores* in each Jaw.——The two in the Upper Jaw are called *Eye-teeth*, from the Communication of Nerves which is ſaid to be betwixt them and he Eyes.——The two in the Lower Jaw are named *angular* or *Wike-teeth*, becauſe they ſupport the Angles of the Mouth.

The *Canini* are broader, longer, and ſtronger, han the *Inciſores*.——Their Baſes are formed nto a ſharp Edge, as the *Inciſores* are; only hat the Edge riſes into a Point in the Middle.—Each of them has generally but one long Root, ho' ſometimes they have two (*a*). The Roots re crooked towards the End.——The *Canini* of he Upper Jaw are larger, longer, and with more crooked Roots, than thoſe of the Under aw.——The Form of their Baſe is fit both for iercing and cutting, and the long crooked Root of each, makes it ſecure in the Socket.

The *Canini* of a Child are in much the ſame Condition as the *Inciſores* are.

The *Dentes molares*, or *Grinders* †, which ave got their Name becauſe they grind our ood, are generally five in each Side of each aw; in all twenty. Their Baſes are broader, more ſcabrous, and with a thinner cortical Subance, than the other Teeth. They have alſo ore Roots, and as theſe Roots generally divaricate from each other, the Partitions of the Sockets between them bear a large ſhare of the great Preſſure they ſuffer, and hinder it to act on their Points (*a*).

‖ Κυνόδοντες, Riſorii, fractorii, collaterales, columellares.

(*a*) *Fauchard*, Chirurgien Dentiſte, chap. 1.

† Μυλῖται, γόμφοι, μύλοι, πλατεῖς, φραςῆρες, maxillares, enſales, clavales, buccarum.

The Baſe of the firſt Grinder has an Edge pointed in the Middle, on its Outſide, reſem-bling the *Canini ;* from which it ſlops inwards, till it riſes again into a Point.——It has gene-rally but one Root, which ſometimes is long and crooked at its Point.

The ſecond *Dens molaris* has two Points on its Baſe, riſing near equally on its Out and In-ſide.——It has two Roots, either ſeparate or run together, but ſhorter than the Root of the firſt.——Theſe two anterior Grinders are much ſmaller than the three that are placed farther back in the Mouth.

The third and fourth are very broad in their Baſes, with four or five Points ſtanding out and they have three or more Roots.

The fifth, called commonly *Dens ſapientiæ* * from its coming through the Gums later than the other Grinders, has four Points on its Baſe which is not ſo large as the Baſe of the third and fourth, and its Roots are leſs numerous.

The *Inciſores* of the Upper Jaw being broade than thoſe of the Lower Jaw, make the ſupe rior Grinders to be placed ſo much farther bac than the Lower ones, that when they are brough together, by ſhutting the Mouth, the Points c the Grinders of the one Jaw enter into the De preſſior

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(*a*) Lettre ſur l'Oſteologie.

* Σωφρονιςῆρες, κραντῆρες, ὀψίγονοι, ſenſûs, intellectûs, ſ rotini, ætatem complentes, genuini, moderatores.

preſſions of the oppoſite Grinders, and they are all equally applied to each other, notwithſtanding the Inequality of their Surface.

The numerous Roots of the *Dentes molares* prevent their looſening by the lateral Preſſure they ſuffer in grinding; and as the Sockets in the Upper Jaw are more ſpongy, and the Teeth are more liable, by their Situation, to fall out (*a*), the Grinders there have more numerous and more ſeparated Roots than in the Lower Jaw (*b*). The Number however of the Roots of the Teeth of both Jaws is very uncertain; ſometimes they are more, ſometimes fewer; frequently ſeveral Roots are joined together; at other times they are all diſtinct. The Diſpoſition of ſuch as are diſtinct, is alſo various; for in ſome the Roots ſtand out ſtreight, in others they ſeparate, and in others again they are crooked inwards. When the Roots are united, we can ſtill diſtinguiſh them, by remarking the Number of ſmall Holes at their Points, which determine the Number of Roots each Tooth ought to be reckoned to have.

At the Time of Birth, only two *Dentes molares* in each Jaw have begun to oſſify, and that at little more than the Baſe, which has ſeveral ſharp Points ſtanding out from it.—The temporaneous Grinders are placed more directly upon the internal Set than the other two Claſſes are; ſometimes there is a Piece of the Bone of the Jaws between the two Sets; in other

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(*a*) *Galen.* de Oſſib. cap. 5.

(*b*) *Fauchard.* Chirurg. Dent. chap. 1.

ther Children, the two Sets have no Bone interpoſed between them.

From what has been ſaid, the Anſwers to the following Queries may be given.

+ Why are Children ſubject to Salivation, Fevers, Convulſion, Vomiting, Purging, &c. when their Teeth are breeding or cutting the Gums.

Why in Children do the *Dentes inciſores* firſt cut the Gums, the *Canini* next, and *Molares* laſt?

Why do Children ſhed their Teeth?

Wherefore have theſe *temporaneous* Teeth generally no Roots, or very ſmall ones?

Why have theſe firſt Teeth ſometimes Roots, and that more frequently in Teeth pulled by Art than in thoſe which are ſhedded by Nature (*a*)?

Why do theſe Roots frequently come outwards through the Gums?

Whence come *Butter* or *Buck* Teeth?

How do theſe Teeth ſometimes go into the natural Row with the others, after pulling a rotten Tooth near them?

How have ſome People got two Rows of Teeth in one or both Jaws? (*b*)

Why do the Teeth of old People looſen, and then drop out entire?

Whence ariſe the new Sets of Teeth which ſeveral old People obtain (*c*)?

Why are not the Gums of toothleſs old People torn by the hard Sockets in chewing?

Why

(*a*) *Fauchard*, Chirurgien Dentiſte *p.* 7.

(*b*) *Blaſ.* Comment. ad Veſling. ſyntagm. cap. 13.

(*c*) *Hoffman.* in van. Horn. Microcoſm. p. 38.

Why are the Teeth inſenſible when ſlightly filed or raſped?

How come they to be ſenſible of Heat or Cold, to be ſet on Edge by Acids, or to give an uneaſy Senſation when gritty or ſandy Subſtances are rubbed between them?

Why does a Perſon who has a pain'd Tooth imagine it longer than any other?

What is the Reaſon of ſome Perſons dying convulſed, upon raſping or filing down an overgrown Tooth (*a*)?

How do the Teeth break and moulder away without any Pain in ſome People and not in others.

What Parts are affected in the Tooth-ach?

What are the cauſes of the Tooth-ach?

May Worms be reckoned among theſe Cauſes (*b*)?

Why are the *Dentes molares* moſt ſubject to that Diſeaſe?

In what different Manners ought the ſeveral Claſſes of Teeth to be extracted when ſuch an Operation is neceſſary?

Whence proceeds the violent obſtinate *Hemorrhagy* which ſometimes attends the drawing of Teeth (*c*)?

Why is it more difficult and dangerous to draw the Eye-teeth than any other?

What

[illegible] *Bartholin.* Anat. reformat. lib. iv. cap. 12.

(*b*) *Jacob.* in Act. Hafn. Vol. 5. Obſ. 108 — Pechlin. Obſerv. Medic. lib. 2. Obſ. 36.—Bartholin. Hiſt. medic. Cent. 3. Hiſt. 96.

(*c*) *Paré* livre 6. chap. 2. —— *Rolfinc.* lib. 2. cap. 27. & —— *Moebii* fundam. Medicin. cap. 9. Ephemerid. Germ. Dec. 1. ann. 3. obſ. 316.—— *Fauchard.* Chirurg. Dentiſte, Tom. 1. chap. 23. obſerv. 7.

What makes it impoſſible frequently to draw *Grinders*, without bringing away Part of the Jaw-bone with them, or breaking the Fangs?

Why do Teeth ſoon replaced after being extracted, become again fixed in the Sockets. (*a*)?

According to the Diviſion made of the Skeleton, we ſhould now proceed to the Deſcription of the Trunk of the Body: But muſt firſt conſider a Bone, which cannot well be ſaid to belong to either the Head or the Trunk; nor is it immediately joined to any other, and therefore is very ſeldom preſerved with Skeletons. However, it is generally deſcribed by Authors, after the Bones of the Face: In obedience therefore to the prevailing Method, I ſhall next examine the Structure of

The *OS HYOIDES* *, which is ſituated horizontally between the Root of the Tongue, and the *Larynx*. It is properly enough named named *Hyoides*, from the Reſemblance it bears to the *Greek* Letter *υ*, and may, for a clearer Demonſtration of its Structure, be diſtinguiſhed into its *Body*, *Cornua*, and *Appendices*.

The Body is the middle broad Part, convex before, and hollow behind.——The convex Fore-part is divided into two, by a Ridge, into the Middle of which the *Mylo-hyoidei*, and into the Sides the *Stylo-hyoidei* Muſcles are inſerted.——Above the Ridge, the Bone is horizontal, but pitted in the Middle by the Inſertion

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(*a*) *De la Motte* Chirurgie, tome 1. chap. 4. obſ. 2.—*Fauchard*, Chirurgien Dentiſte, tome 1. chap. 29.

* Hypſyloides, Lambdoides, παραστάτη, φαρυγγέτερον, os gutturis, os linguæ, os morſus Adami, aſſeſſor, os laude, bicorne.

ſertion of the two *Genio-hyoidei* Muſcles, and a little hollowed more laterally by the *Baſſio-gloſſi.*——Below the Ridge, it is convex, but a little flatted in the Middle by the *Sterno-hyoidei*, and pitted more externally by the *Coraco-hyoidei.*——The Concavity behind faces backwards and downwards to receive the *Thyroid* Cartilage, when the *Larynx* and the *Os hyoides* are pulled towards each other by the Action of the *Sterno-hyoidei* and *Hyothyroidei* Muſcles; and to its upper Edge, the ligamentous Membranes of the *Epiglottis*, Tongue, and *Thyroid* Cartilage, are fixed.

The *Cornua* of the † *Os hyoides* are ſtretched backwards from each Side of its Body, where often a ſmall Furrow points out the former Separation; for in young Subjects, the Body and *Cornua* are not one continued Subſtance, as they come afterwards to be in Adults.——Theſe *Cornua* are not always ſtreight, nor of equal Length; their two plain Surfaces ſtand obliquely, ſloping from above outwards and downwards.——Into the external, the *Cerato-gloſſus* is inſerted above, and the *Thyro-hyoideus* Muſcle below; and to the one behind, the ligamentous Membrane of the Tongue and *Larynx* adheres. Each of the *Cornua* becomes gradually ſmaller, as it is extended from the Baſe; but ends in a round Tubercle, from which a moveable Cartilage ſtands out, which is connected to the upper Proceſs of the *Cartilago Thyroidea.*

Where the Body of the *Os hyoides* joins on each Side with its *Cornua*, a ſmall Styliform

Proceſs,

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† Crura, Latera inferiora.

Proceſs, called *Appendix* ‡, riſes upwards and backwards, into which the *Muſculi Stylo-hyoidei alteri*, and Part of the *Hyo-gloſſi* Muſcles are fixed. From each of them a Ligament is ſometimes extended to the *Styloid* Proceſſes of the temporal Bones, to keep the *Os hyoides* from being drawn too much forwards or downwards. The Part of this Ligament next to theſe Proceſſes ſometimes forms into ſeveral Cartilages, which afterwards oſſify in old People. *Ruyſch* (*a*) ſays that he has ſeen this Oſſification continued as far up as the ſtyloid Proceſſes, which were therefore joined to the *Os hyoides* by *Anchyloſis*.

The Subſtance of the *Os hyoides* is cellular, but covered with a firm external Plate, which is of ſufficient Strength to bear the Actions of ſo many Muſcles as are inſerted into it.

It is not articulated with any Bone of the Body, except by Means of the Muſcles and Ligaments mentioned.

The Uſe of the *Os hyoides*, is to ſerve as a ſolid Lever for the Muſcles to act with, in raiſing or depreſſing the Tongue and *Larynx*, or in enlarging and diminiſhing the Capacity of the *Fauces*.

At Birth, this Bone is in a cartilaginous State; excepting a ſmall Point of Bone in the Middle of its Body, and in each of the *Cornua*.—— The *Appendices* frequently remain cartilaginous many Years.

Of

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‡ Crura ſuperiora, Latera ſuperiora, Oſſa graniformia.

(*a*) Adverſ. Anat. Dec. 3. § 9.

Of the TRUNK.

THE *TRUNK* conſiſts of the *Spine*, *Pelvis*, and *Thorax*.

The *SPINE*[*] is the long Pile of Bones extended from the *Condyles* of the *Occiput*, to the End of the Rump. It ſomewhat reſembles two unequal Pyramids joined in a common Baſe. It is not, however, ſtreight; for its upper Part being drawn backwards by ſtrong Muſcles, it gradually advances forwards, as it deſcends to ſupport the *OEſophagus*, Veſſels of the Head, *&c.* Then it turns backwards, to make Place enough for the Heart and Lungs. It is next bended forwards, to ſupport the *Viſcera* of the *Abdomen*. It afterwards turns backwards, for the Enlargement of the *Pelvis*. And, laſtly, it is reflected forwards, for ſuſtaining the loweſt great Gut.

The *Spine* is commonly divided into *true* and *falſe Vertebræ;* the former conſtituting the long upper Pyramid, which has its Baſe below, while the *falſe Vertebræ* make the ſhorter lower Pyramid, whoſe Baſe is above.

The *TRUE VERTEBRAE*[†] are the twenty four upper Bones of the *Spine*, on which the ſeveral Motions of the Trunk of our Bodies are performed; from which Uſe they have juſtly got their Name.

Each of theſe *Vertebræ* is compoſed of its Body and Proceſſes.

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[*] ʼΡαχις, νωτον, ἄκανθα, ἱέρα σύριγξ, σωλην, Tergum, Hominis Carina.

[†] Στροφεῖς, ϛρόφιγγες, Spondyli, oſſa orbiculata; oſſa vertebrata, verticula.

The Body is the thick ſpongy Fore-part, which is convex before, concave backwards, horizontal and plain in moſt of them above and below.——Numerous ſmall Holes, eſpecially on the Fore and Back-part of their Surface, give Paſſage to their Veſſels, and allow the Ligaments to enter their Subſtance.—The Edges of the Body of each *Vertebra* are covered, eſpecially at the Fore-part, with a Ring of Bone firmer and more ſolid than the Subſtance of the Body any where elſe. Theſe Rings ſeem to be joined to the *Vertebræ* in the Form of *Epiphyſes*, but are alledged by ſome (*a*) to be the Ligaments oſſified. They are of great Uſe in preventing the ſpongy Bodies from being broken in the Motions of the Trunk.

Between the Bodies of each two adjoining *Vertebræ*, a Subſtance between the Nature of Ligament and Cartilages is interpoſed; which ſeems to conſiſt of concentrical curve Fibres, when it is cut horizontally; but when it is divided perpendicularly, the Fibres appear oblique and decuſſating each other (*b*).—The outer Part of the intervertebral Ligaments is the moſt ſolid and hard; and they gradually become ſofter, till they are almoſt in the Form of a glairy Liquor in the Center; and therefore theſe Subſtances were not improperly called *mucous Ligaments* by the Ancients (*c*). The external fibrous Part of each is capable of being greatly extended, and of being compreſſed into a very ſmall Space, while the middle fluid Part

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(*a*) *Fallop.* Obſervat. Anatom.

(*b*) *Blancard*, Anat. reform. cap. 32.—*Weitbrecht*. Syndeſmolog. Sect. 4. § 15.

(*c*) *Galen*. de uſu Part. lib. 12. cap. 16.

Part is incompreſſible, or nearly ſo; and the Parts of this Ligament between the Circumference and Center approach in their Properties to either, in Proportion to their more ſolid or more fluid Texture. The middle Point is therefore a *Fulcrum*, or *Pivot*, on which the Motion of a Ball and Socket may be made, with ſuch a gradual yielding of the Subſtance of the Ligament, in which ever Direction our Spines are moved, as ſaves the Body from violent Shocks, and their dangerous Conſequences (*c*). ——This Ligamento-cartilaginous Subſtance is firmly fixed to the horizontal Surfaces of the Bodies of the *Vertebræ*, to connect them, in which it is aſſiſted by a ſtrong membranous Ligament, which lines all their concave Surface, and by ſtill a ſtronger Ligament that covers all their anterior convex Surface.

We may lay it down as a general Rule, notwithſtanding ſome Exceptions, That the *Bodies* of the *Vertebræ* are ſmaller, and more ſolid above, but as they deſcend, they appear larger and more ſpongy; and that the Cartilages between them are thick, and the ſurrounding Ligaments ſtrong in Proportion to the Largeneſs of the *Vertebræ*, and to the Quantity of Motion they perform: By which Diſpoſition, the greater Weight is ſupported on the broadeſt beſt ſecured Baſe, and the Middle of our Body is allowed a large and ſecure Motion.

From each Side of the Body of each *Vertebra*, a bony Bridge is produced backwards, and to a Side; from the poſterior End of which, one

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(*c*) Medical Eſſays and Obſerv. Vol. V. Art. 28.

one ſlanting Proceſs riſes, and another deſcends; the ſmooth, and what is generally the flatteſt Side of each of theſe four Proceſſes, which are called the *oblique* *, is covered with a ſmooth Cartilage; and the two lower ones of each *Vertebra* are fitted to, and articulated with the two upper or aſcending oblique Proceſſes of the *Vertebra* below, having their articular Ligaments fixed into the rough Line round their Edges.

From between the oblique Proceſſes of each Side, the *Vertebra* is ſtretched out laterally into a Proceſs that is named *Tranſverſe*.

From the Back-part of the Roots of the two oblique, and of the tranſverſe Proceſs of each Side, a broad oblique bony Plate is extended backwards, where theſe meet, the ſeventh Proceſs of the *Vertebræ* takes its Riſe, and ſtands out backwards: This being generally ſharp-pointed and narrow-edged, has therefore been called *Spinal* Proceſs; from which this whole Chain of Bones has got its Name.

Beſides the common Ligament which lines all the internal Surface of the ſpinal Proceſſes, as well as of the Bodies, there are particular Ligaments that connect the bony Bridges and Proceſſes of the contiguous *Vertebræ* together.

The Subſtance of the Proceſſes is conſiderably ſtronger and firmer, and has a thicker external Plate than the Bodies of the *Vertebræ* have.

The ſeven Proceſſes form a Concavity at their Fore-part, which, joined to the one at the Back-part of the Bodies, makes a great *Foramen*, and the *Foramina* of all the *Vertebræ* form a long large Conduit *, for containing the *ſpinal Marrow.*——In the upper and lower Edge of each *lateral Bridge*, there is a Notch. Theſe are ſo adapted to each other in the contiguous *Vertebræ*, as to form a round Hole in each Side between each two *Vertebræ*, through which the Nerves that proceed from the *ſpinal* Marrow, and its Blood-veſſels, paſs.

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* Articulatorii, minimi.

The Articulations then of theſe *true Vertebræ* are plainly double; for their Bodies are joined by the interveening Cartilage above deſcribed, and their oblique Proceſſes being tipped with Cartilages, are ſo connected by their Ligaments, as to allow a ſmall Degree of Motion to all Sides. Hence it is evident, that their Center of Motion is altered in different Poſitions of the Trunk: For when we bow forwards, the upper moved Part bears entirely on the Bodies of the *Vertebræ*: If we bend back, the oblique Proceſſes ſupport the Weight: If we recline to one Side, we reſt upon the oblique Proceſſes of that Side and Part of the Bodies: If we ſtand erect, all the Bodies and oblique Proceſſes have their Share in our Support.

Hence it follows, 1. That becauſe the Joints, of which the Spine is compoſed, are ſo numerous, the *ſpinal* Marrow, Nerves, Blood-veſſels, *&c.* are not liable to ſuch Compreſſion, and over-ſtretching in the Motion of the Trunk of the Body, as they would otherwiſe be, ſince ſeveral *Vertebræ* muſt be concerned in every Motion of the Spine; and therefore a very ſmall Curvature is made at the Conjunction of any two

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[*] Ἱερᾳ σὺριγξ, σωλήν, Canalis.

two *Vertebræ (a)*. 2. That an erect Poſture is the ſureſt and firmeſt, becauſe the Surface o Contact of the *Fulcra* is largeſt, and the Weight is moſt perpendicular to them *(b)*. 3. That the Muſcles which move the Spine, act with greater Force in bringing the Trunk to an erect Poſture, than in drawing it to any other: For in bending forwards, backwards, or to a Side, the Muſcles which perform any of theſe Action are nearer the Center of Motion; conſequently the Lever with which they act is ſhorter, than when the Center of Motion is on the Part o the *Vertebra*, oppoſite to that where theſe Muſcles are inſerted; which is the Caſe in raiſing the Trunk. This is extremely neceſſary; ſince in the Deflections of the Spine from a perpendicular Bearing, the Weight of the Body ſoo inclines it which Way we deſign; whereas, in raiſing us erect, this great Weight muſt b more than counteracted. 4. In calculating th Force exerted by the Muſcles which move th Spine, we ſhould always make Allowance fo the Action of the Cartilages between the *Vertebræ*, which, in every Motion from an erec Poſture, muſt be ſtretched on one Side, an compreſſed on the other, to both which the reſiſt; whereas, in raiſing the Trunk, theſ Cartilages aſſiſt by their ſpringy Force *(c)*. 5 We are hence naturally led into the Reaſon o our Height of Stature increaſing in the Morn

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(a) *Galen.* de uſu Part. lib. 12. cap. 12.

(b) *Paaw* de Oſſib. Parſ. 2. cap. 3.

(c) *Borelli*, de motu Animal. pars. 1. ſchol. ad Propoſ. 5 —*Parent*. Hiſtoire de l'Acad. des Sciences, 1702.

ing, and diminiſhing at Night (*a*): For the intermediate Cartilages of the *Vertebræ* being preſſed all Day long by the Weight of our Body, become more compact and thin in the Evening; but when they are relieved from this Preſſure in the Night, they again expand themſelves to their former Thickneſs; and ſeeing the Bulk of any Part muſt vary according to the different Diſtenſion or Repletion of the Veſſels compoſing it, we may underſtand how we become taller after a plentiful Meal, and decreaſe after Faſting or Evacuations (*b*). 6. From the different Articulations of the Bodies, and oblique Proceſſes of the *Vertebræ*, and the different Strength of the Ligaments, it is plain, that they are formed ſo as to allow much larger Motion forwards than backwards; this laſt being of much leſs Uſe, and might be dangerous, by overſtretching the large Blood-veſſels that are contiguous to the Bodies of the *Vertebræ* (*c*). 7. The intervertebral Cartilages ſhrivelling as they become more ſolid by Age, is the Cauſe why old People generally bow forwards, and cannot raiſe their Bodies to ſuch an erect Poſture as they had in their Youth.

The *true Vertebræ* ſerve to give us an erect Poſture; to allow ſufficient and ſecure Motion to the Head, Neck, and Trunk of the Body, and to ſupport and defend the Bowels, and other ſoft Parts.

At the ordinary Time of Birth, each *Vertebra* conſiſts of three bony Pieces, connected by

Carti-

(*a*) *Waſſe*, Philoſoph. Tranſact. Num. 383. Art. 1.
(*b*) *Abbé Fontenu*, Hiſtoire de l'Acad. des Sciences, 1725.
(*c*) *Galen.* de uſu Part. lib. 1. cap. 16.

Cartilages; to wit, the *Body*, which is not fully oſſified, and a long crooked Bone on each Side; on which we ſee a ſmall Share of the bony Bridge, the oblique Proceſſes compleat, the beginning tranſverſe Proceſſes, and the oblique Plate, but no ſpinal Proceſs; ſo that the Teguments are in no Danger of being hurt by the ſharp Ends of theſe ſpinal Proceſſes, while a Child is in its bended Poſture in the Womb, nor while it is ſqueezed in the Birth.

From this general Mechaniſm of the Spine, an Account is eaſily deduced of all the different preternatural Curvatures which the Spine is capable of: For if one or more *Vertebræ*, or their Cartilages, are of unequal Thickneſs in oppoſite Sides, the Spine muſt be reclined over to the thinner Side; which now ſuſtaining the greateſt Share of the Weight, muſt ſtill be more compreſſed, conſequently hindered from extending itſelf in Proportion to the other Side, which, being too much freed of its Burden, has Liberty to enjoy a luxuriant Growth. The Cauſes on which ſuch an Inequality of Thickneſs in different Sides of the *Vertebræ* depends, may vary: For either it may be owing to an Over-diſtenſion of the Veſſels of one Side, and from thence a preternatural Increaſe of the Thickneſs of that Part; or, which more commonly is the Caſe, it may proceed from an Obſtruction of the Veſſels, by which the Application of proper Nouriſhment to the bony Subſtance is hindered, whether that Obſtruction depends on the faulty Diſpoſition of the Veſſels or Fluids; or if it is produced by an unequal mechanical Preſſure, occaſioned by a paralytic

Weakneſs of the Muſcles and Ligaments, or by a ſpaſmodic Over-action of the Muſcles on any Side of the Spine, or by People continuing long, or putting themſelves frequently into any Poſture declining from the erect one: In all theſe Caſes one common Effect follows, to wit, the *Vertebræ*, or their Cartilages, or both, turn thick on that Side where the Veſſels are free, and remain thin on the other Side where the Veſſels are ſtraitned or obſtructed. —— Whenever any morbid Curvature is thus made, a ſecond Turn, but in an oppoſite Direction to the former, muſt be formed; both becauſe the Muſcles on the convex Side of the Spine being ſtretched, muſt have a ſtronger natural Contraction to draw the Parts to which their Ends are fixed, and becauſe the Patient makes Efforts to keep the Center of Gravity of the Body perpendicular to its Baſe, that the Muſcles may be relieved from a conſtant violent contractile State, which always creates Uneaſineſs and Pain.

When once we underſtand how theſe crooked Spines are produced, there is little Difficulty in forming a juſt Prognoſis; and a proper Method of Cure may be eaſily contrived, which muſt vary as to the internal Medicines, according to the different Cauſes on which the Diſeaſe depends: But one general Indication muſt be purſued by Surgeons; which is, to counteract the bending Force, by increaſing the Compreſſion on the convex Part of the Curvature, and diminiſhing it on the concave Side. The Manner of executing which in particular Caſes muſt be different, and requires a very accurate Examination of the Circumſtances both of the Diſeaſe and Patient. In many ſuch Caſes, I have found ſome ſimple Directions, as to Poſtures in which the Patient's Body ſhould be kept, of very great Advantage.

Though the *true Vertebræ* agree in the general Structure which I have hitherto deſcribed, yet becauſe of ſeveral Specialities proper to a particular Number, they are commonly divided into three Claſſes, *viz. Cervical*, *Dorſal*, and *Lumbar.*

The *Cervical* † are the ſeven uppermoſt *Vertebræ;* which are diſtinguiſhed from the reſt by theſe Marks.——Their Bodies are ſmaller and more ſolid than any others, and flatted on the Fore-part, to make Way for the *OEſophagus;* or rather this flat Figure is owing to the Preſſure of that Pipe, and to the Action of the *longi Colli* and anterior *recti* Muſcles.——They are alſo flat behind, where ſmall Proceſſes riſe, to which the internal Ligaments are fixed.——The upper Surface of the Body of each *Vertebra* is made hollow, by a ſlanting thin Proceſs which is raiſed on each Side:——The lower Surface is alſo excavated, but in a different Manner; for here the poſterior Edge is raiſed a little, and the one before is produced a conſiderable Way.——Hence we ſee how the Cartilages between thoſe Bones are firmly connected, and their Articulations are ſecure.

The Cartilages between theſe *Vertebræ* are thick, eſpecially at their Fore-part; which is one Reaſon why the *Vertebræ* advance forward as they deſcend, and have larger Motion.

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† Τραχηλȣ, ἀυχής, Colli.

The oblique Proceſſes of theſe Bones of the Neck more juſtly deſerve that Name, than thoſe of any other *Vertebræ*. They are ſituated ſlanting; the upper ones having their ſmooth and almoſt flat Surfaces facing obliquely backwards and upwards, while the inferior oblique Proceſſes have theſe Surfaces facing obliquely forwards and downwards.

The tranſverſe Proceſſes of theſe *Vertebræ* are framed in a different Manner from thoſe of any other Bones of the Spine: For beſides the common tranſverſe Proceſs riſing from between the oblique Proceſſes of each Side, there is a ſecond one that comes out from the Side of the Body of each *Vertebra*; and theſe two Proceſſes, after leaving a circular Hole for the Paſſage of the cervical Artery and Vein, unite, and are conſiderably hollowed at their upper Part, with riſing Sides, to protect the Nerves that paſs in the Hollow; and at laſt each Side terminates in an obtuſe Point, for the Inſertion of Muſcles.

The ſpinal Proceſſes of theſe cervical Bones ſtand nearly ſtreight backwards, are ſhorter than thoſe of any other *Vertebræ*, and are forked or double at their Ends; and hence allow a more convenient Inſertion to Muſcles.

The thick Cartilages between the Bodies of theſe *cervical Vertebræ*, the Obliquity of their *oblique* Proceſſes, and the Shortneſs and horizontal Situation of their *ſpinal* Proceſſes, all conſpire to allow them large Motion.

The Holes between the bony croſs Bridges, for the Paſſage of the Nerves from the *Medulla ſpinalis*, have their largeſt Share formed in the loweſt of the two *Vertebræ*, to which they are common.

So far moſt of the cervical *Vertebræ* agree; but they have ſome particular Differences, which oblige us to conſider them ſeparately.

The firſt, from its Uſe of ſupporting the Head, has the Name of *Atlas* †; and is alſo called *Epiſtrophea*, from the Motion it performs on the ſecond.

The *Atlas*, contrary to all the other *Vertebræ* of the Spine, has no Body; but, inſtead of it, there is a bony Arch.——In the convex Fore-part of which, a ſmall Riſing appears, where the *Muſculi longi colli* are inſerted; and, on each Side of this Protuberance, a ſmall Cavity may be obſerved, where the *Recti interni minores* take their Riſe.——The upper and lower Parts of the Arch are rough and unequal, where the Ligaments that connect this *Vertebra* to the *Os occipitis*, and to the ſecond *Vertebra* are fixed.——The Back-part of the Arch is concave, ſmooth, and covered with a Cartilage, in a recent Subject, to receive the Tooth-like Proceſs of the ſecond *Vertebra*.——In a firſt *Vertebra* from which the ſecond has been ſeparated, this Hollow makes the Paſſage for the *ſpinal* Marrow to ſeem much larger than it really is: On each Side of it a ſmall rough Sinuoſity may be remarked, where the Ligaments going to the Sides of the Tooth-like Proceſs of the following

Vertebra

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† Αϛραγαλος.

fiddle, and is joined as an Appendix to the
ody of the Bone.——Leſt this Appendix be
ended or diſplaced, Nurſes ought to keep the
eads of new-born Children from falling too
r backwards, by *Stay-bands*, or ſome ſuch
Ieans, till the Muſcles attain Strength ſufficient
prevent that dangerous Motion.

When we are acquainted with the Structure
d Articulations of the firſt and ſecond *Verte-*
æ, and know exactly the Strength and Con-
exion of their Ligaments, there is no Difficul-
in underſtanding the Motions that are per-
rmed upon or by the firſt; though this Sub-
ct was formerly Matter of hot Diſpute among
me of the greateſt Anatomiſts (a). It is
one of my Purpoſe at preſent to enter into a
etail of the Reaſons advanced by either Part;
it to explain the Fact, as any one may ſee
who will remove the Muſcles, which, in a
cent Subject, hinder the View of theſe two
ints, and then will turn the Head into all the
fferent Poſitions it is capable of. The Head
ay then be ſeen to move forwards, and back-
ards on the firſt *Vertebra*, as was already ſaid,
hile the *Atlas* performs the *Circumgyratio* upon
e ſecond *Vertebra;* the inferior oblique Pro-
ſſes of the firſt *Vertebra* ſhufling eaſily in a
rcular Way on the ſuperior oblique Proceſſes
the ſecond, and its Body or anterior Arch
ving a Rotation on the Tooth-like Proceſs,
which the perpendicular Ligament that is
nt from the Point of the Tooth-like Proceſs
the occipital Bone is twiſted, while the la-
ral Ligaments that fix the *Proceſſus dentatus*
to

(a) See *Euſtach.* de motu Capitis.

to the Sides of the firſt *Vertebra*, and to the *Os occipitis*, are very differently affected; for the one upon the Side towards which the Face is turned by the *Circumgyratio*, is much ſhortned and lax, while the oppoſite one is ſtretched and made tenſe, and, yielding at laſt no more, prevents the Head from turning any further round on this *Axis*. So that theſe lateral Ligaments are the proper *Moderators* of the *Circumgyratio* of the Head here, which muſt be larger or ſmaller, as theſe Ligaments are weaker or ſtronger, longer or ſhorter, and more or leſs capable of being ſtretched.——Beſides the Revolution on this *Axis*, the firſt *Vertebra* can move a ſmall Way to either Side; but is prevented from moving backwards and forwards, by its anterior Arch, and by the croſs Ligament which are both cloſely applied to the Tooth-like Proceſs. Motion forwards here would have been of very bad Conſequence, as it would have brought the Beginning of the *ſpinal* Marrow upon the Point of the Tooth-like Proceſs.

The rotatory Motion of the Head is of great Uſe to us on many Accounts, by allowing us to apply quickly our Organs of the Senſes to Objects: And the *Axis* of Rotation was altogether proper to be at this Place; for if it had been at a greater Diſtance from the Head, the Weight of the Head, if it had at any time been removed from a perpendicular Bearing to the ſmall very moveable Joint, and thereby had acquired a long Lever, would have broke the Ligaments at every Turn inconſiderately performed; or theſe Ligaments muſt have been formed much ſtronger than could have been connected

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Vertebra are faſtened; and on each Side, a ſmall rough Protuberance and Depreſſion is obſervable, where the tranſverſe Ligament, which ſecures the Tooth-like Proceſs in the Sinuoſity, is fixed, and hinders that Proceſs from injuring the *Medulla ſpinalis* in the Flexions of the Head.

The *Atlas* has as little ſpinal Proceſs as Body; but, inſtead thereof, there is a large bony Arch, that the Muſcles which paſs over this *Vertebra* at that Place, might not be hurt in extending the Head. On the Back and Upper Part of this Arch there are two Depreſſions, where the *Recti poſtici minores* take their Riſe; and at the lower Part are two other Sinuoſities, into which the Ligaments which connect this Bone to the following one are fixed.

The ſuperior oblique Proceſſes of this *Atlas* are large, oblong, hollow, and more horizontal than in any other *Vertebra.*——They riſe more in their external than internal Brim; by which their Articulations with the *Condyloid* Proceſſes of the *Os occipitis* are firmer.——Under the external Edge of each of theſe oblique Proceſſes, is the *Foſſa*, or deep open Channel, in which the vertebral Arteries make the circular Turn, as they are about to enter the great *Foramen* of the occipital Bone, and where the tenth Pair of Nerves goes out.——In ſeveral Bodies, I have ſeen this *Foſſa* covered with Bone. ——The inferior oblique Proceſſes extending from within outwards and downwards, are large, concave, and circular. So that this *Vertebra*, contrary to the other ſix, receives the Bones with which it is articulated both above and below.

The tranſverſe Proceſſes here are not muc
hollowed or forked, but are longer and large
than thoſe of any other *Vertebra colli*, for th
Origin and Inſertion of ſeveral Muſcles; o
which thoſe that ſerve to move this *Vertebra* o
the ſecond have a conſiderable Lever to ac
with, becauſe of the Diſtance of their Inſertio
from the *Axis* of Revolution.

The Hole for the *ſpinal Marrow* is larger i
this than in any other *Vertebra*, not only o
account of the *Marrow* being largeſt here, bu
alſo to prevent its being hurt by the Motions o
this *Vertebra* on the ſecond one.——This larg
Hole, and the long tranſverſe Proceſſes, mak
this the broadeſt *Vertebra* of the Neck.

The *Condyles* of the *Os occipitis* move for
wards and backwards in the ſuperior obliqu
Proceſſes of this *Vertebra*; but from the Figur
of the Bones forming theſe Joints, it appear
that very little Motion can here be allowed t
either Side; and there muſt be ſtill leſs circula
Motion.

In new-born Children this *Vertebra* has onl
the two lateral Pieces oſſified; the Arch, whic
it has at its Fore-part inſtead of a Body, bein
cartilaginous.

The ſecond *Vertebra colli* is called *Dentat*
from the Tooth-like Proceſs on the upper Par
of its Body. Some Authors call it *Epiſtrophe*
but improperly, ſince this Deſignation is onl
applicable to the firſt, which moves on this a
on an Axis.

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The Body of this *Vertebra* is ſomewhat of a
yramidal Figure, being large, and produced
ownwards, eſpecially at its Fore-ſide, to enter
nto a Hollow of the *Vertebra* below; while
e upper Part has a ſquare Proceſs with a ſmall
oint ſtanding out from it. This it is that is i-
agined to reſemble a Tooth *, and has given
ame to the *Vertebra*.——The Side of this Pro-
eſs, which plays in the Hollow of the anterior
rch of the firſt *Vertebra*, is convex, ſmooth,
nd covered with a Cartilage; and it is of the
me Form behind, for moving on the Liga-
ent which is extended tranſverſely from one
ugh Protuberance of the firſt *Vertebra* to the
her, and is cartilaginous in the Middle, where
is Tooth-like Proceſs plays on it.——A Liga-
ent likewiſe goes out in an oblique tranſverſe
irection, from each Side of the *Proceſſus den-*
tus, to be fixed at its other End to the firſt
ertebra, and to the occipital Bone; and ano-
er Ligament riſes up from near the Point of
e Proceſs to the *Os occipitis*.

The ſuperior oblique Proceſſes of this *Ver-*
bra dentata are large, circular, very nearly
an horizontal Poſition, and ſlightly convex,
be adapted to the inferior oblique Proceſſes of
e firſt *Vertebra*.—— A moveable Cartilage is
d by ſome Authors to be interpoſed between
eſe oblique Proceſſes of the firſt and ſecond
rtebra; but I could never find it.—— The
ferior oblique Proceſſes of this *Vertebra den-*
a anſwer exactly to the Deſcription given of
oſe common to all the cervical *Vertebræ*.

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* Conoides, Pyrenoides, Odontoides.

The tranſverſe Proceſſes of the *Vertebra den tata* are ſhort, very little hollowed at the upper Part, and not forked at their Ends; an the Canals through which the cervical Arteri paſs, are reflected outwards about the middl Subſtance of each Proceſs; ſo that the Cour of theſe Veſſels may be directed towards th tranſverſe Proceſſes of the firſt *Vertebra*.—— Ha this Curvature of the Arteries been made in Part ſo moveable as the Neck is, while the were not defended by a Bone, and fixed to th Bone, ſcarce a Motion could have been pe formed without the utmoſt Hazard of Compre ſion, and a ſtop put to the Courſe of the Liqui with all its Train of bad Conſequences. Henc we obſerve this ſame Mechaniſm ſeveral tim made uſe of, when there is any Occaſion for ſudden Curvature of a large Artery. This the third remarkable Inſtance of it we ha ſeen. The firſt was the Paſſage of the *Carotid* through the *temporal* Bones; and the ſecond w that lately deſcribed in the vertebral Arterie turning round the oblique Proceſſes of the fir *Vertebra*, to come at the great *Foramen oſ* *occipitis*.

The ſpinal Proceſs of this *Vertebra dentata* thick, ſtrong, and ſhort, to give ſufficient Or gin to the *Muſculi recti majores*, and *obliqui i feriores*, and to prevent the Contuſion of the and other Muſcles in pulling the Head back.

This ſecond *Vertebra* conſiſts at the Birt of four Bony pieces: For, beſides the thr which I already mentioned as common to the *Vertebræ*, the Tooth-like Proceſs of th Bone is begun at this Time to be oſſified in i

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ed to ſuch ſmall Bones. Neither could this circular Motion be performed on the firſt *Vertebra* without Danger, becauſe the immoveable Part of the *Medulla oblongata* is ſo near, as, at each large Turn, the Beginning of the *ſpinal* Marrow would have been in danger of being twiſted, and of ſuffering by the Compreſſion this would have made on its tender Fibrils.

It is neceſſary to obſerve, that the *lateral* or *moderator* Ligaments confine ſo much the Motion of the firſt *Vertebra* upon the ſecond, that, though this Joint may ſerve us on ſeveral Occaſions, yet we are often obliged to turn our Faces farther round, than could be done by this Joint alone, without the greateſt danger of twiſting the ſpinal Marrow too much, and alſo of luxating the oblique Proceſſes; therefore, in large Turns of this kind, the Rotation is aſſiſted by all the *Vertebræ* of the Neck and Loins; and if this is not ſufficient, we employ moſt of the Joints of the lower Extremities.——This Combination of a great many Joints towards the Performance of one Motion, is alſo to be obſerved in ſeveral other Parts of the Body; notwithſtanding ſuch Motions being generally ſaid to be performed by ſome ſingle Joint only.

The third *Vertebra* of the Neck is by ſome called *Axis;* but this Name is applied to it with much leſs Reaſon than to the ſecond.——This third, and the three below, have nothing particular in their Structure; but all their Parts come under the general Deſcription formerly given, each of them being larger as they deſcend.

The ſeventh * *Vertebra* of the Neck is near to the Form of thoſe of the Back, having the Upper and Lower Surfaces of its Body leſs hollow than the others:——The oblique Proceſſes are more perpendicular;——neither ſpinal nor tranſverſe Proceſſes are forked.—This ſeventh, and the ſixth *Vertebra* of the Neck, have the Hole in each of their tranſverſe Proceſſes more frequently divided by a ſmall croſs Bridge, that goes between the cervical Vein and Artery, than any of the other *Vertebræ*.

The twelve *Dorſal* † may be diſtinguiſhed from the other *Vertebrae* of the Spine by the following Marks.

Their Bodies are of a middle Size, betwixt thoſe of the Neck and Loins;——they are more convex before than either of the other two Sorts; and are flatted laterally by the Preſſure of the Ribs, which are inſerted into ſmall Cavities formed in their Sides. This flatting on their Sides, which makes the Figure of theſe *Vertebræ* almoſt an half Oval, is of good Uſe; as it affords a firm Articulation to the Ribs, allows the *Trachea arteria* to divide at a ſmall Angle, and the other large Veſſels to run ſecure from the Action of the vital Organs.——Theſe Bodies are more concave behind than any of the other two Claſſes.——Their Upper and Lower Surfaces are horizontal.

The Cartilages interpoſed between the Bodies of theſe *Vertebrae* are thinner than in any other of the *true Vertebræ*; and contribute to the Concavity of the Spine in the Thorax, by being thinneſt at their Fore-part.

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* Atlas quibuſdam, maxima, magna Vertebra, prominens.

† Θώρακος, μεταφρένου, νώτου, ὑποτραχήλιου, Antiſterni, pectoris, tergi.

The *oblique* Proceſſes are placed almoſt perpendicular; the upper ones ſlanting but a little forwards, and the lower ones ſlanting as much backwards.—They have not as much Convexity or Concavity as is worth remarking.——Between the oblique Proceſſes of oppoſite Sides, ſeveral ſharp Proceſſes ſtand out from the upper and lower Parts of the Plates, which join to form the ſpinal Proceſs; into theſe ſharp Proceſſes ſtrong Ligaments are fixed, for connecting the *Vertebræ*.

The *tranſverſe* Proceſſes of the *dorſal Vertebræ* are long, thicker at their Ends than in the Middle, and turned obliquely backwards; which may be owing to the Preſſure of the Ribs, the Tubercles of which are inſerted into a Depreſſion near the End of theſe Proceſſes.

The *Spinal* Proceſſes are long, ſmall-pointed, and ſloping downwards and backwards; from their Upper and Back-part a Ridge riſes, which is received by a ſmall Channel in the Fore-part of the Spinal Proceſs immediately above, which is here connected to it by a Ligament.

The *Conduit* of the *ſpinal* Marrow is here more circular, but, correſponding to the Size of that Cord, is ſmaller than in any of the other *Vertebræ*; and a larger Share of the Holes in the bony Bridges, for the Tranſmiſſion of the Nerves, is formed in the *Vertebra* above, than in the one below.

The Connexion of the *dorſal Vertebræ* to the Ribs, the Thinneſs of their Cartilages, the

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erect Situation of the oblique Proceſſes, the Length, Sloping, and Connexion of the Spinal Proceſſes, all contribute to reſtrain theſe *Vertebræ* from much Motion, which might diſturb the Actions of the Heart and Lungs; and, in Conſequence of the little Motion allowed here, the *intervertebral* Cartilages ſooner ſhrivel, by becoming more ſolid: And therefore the firſt remarkable Curvature of the Spine obſerved, as People advance to old Age, is in the leaſt ſtretched *Vertebræ* of the Back; or old People firſt become round-ſhouldered.

The Bodies of the four uppermoſt *dorſal Vertebræ* deviate from the Rule of the *Vertebræ* becoming larger as they deſcend; for the firſt of the four is the largeſt, and the other three below gradually become ſmaller, to allow the *Trachea* and large Veſſels to divide at ſmaller Angles.

The two uppermoſt *Vertebræ* of the Back, inſtead of being very prominent forwards, are flatted by the Action of the *Muſculi longi colli* and *recti majores*.

The proportional Size of the two little Depreſſions in the Body of each *Vertebra* for receiving the Heads of the Ribs, ſeems to vary in the following Manner: The Depreſſion on the Upper Edge of each *Vertebra* decreaſes as far down as the fourth, and after that increaſes.

The tranſverſe Proceſſes are longer in each lower *Vertebra* to the ſeventh or eighth, with their ſmooth Surfaces, for the Tubercles of the Ribs, facing gradually more downwards; but afterwards as they deſcend they become ſhorter, and the ſmooth Surfaces are directed more upwards.

The ſpinous Proceſſes of the *Vertebræ* of the Back become gradually longer and more ſlanting from the firſt, as far down as the eighth or ninth *Vertebra;* from which they manifeſtly turn ſhorter and more erect.

The firſt * *Vertebra,* beſides an oblong Hollow in its lower Edge, that aſſiſts in forming the Cavity, wherein the ſecond Rib is received, has the whole Cavity for the Head of the firſt Rib formed in it.

The ſecond has the Name of *Axillary* †, without any Thing particular in its Structure.

The eleventh ‡ often has the whole Cavity for the eleventh Rib in its Body, and wants the ſmooth Surface on each tranſverſe Proceſs.

The twelfth ‖ always receives the whole Head of the laſt Rib, and has no ſmooth Surface on its tranſverſe Proceſſes, which are very ſhort.——The ſmooth Surfaces of its inferior oblique Proceſſes face outwards as the *Lumbar* do.——And we may ſay, in general, that the upper *Vertebræ* of the Back loſe gradually their Reſemblance to thoſe of the Neck, and the lower ones come nearer to the Figure of the *Lumbar.*

The Articulation of the *Vertebræ* of the Back with the Ribs, ſhall be more particularly conſidered after the Ribs are deſcribed. Only it

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* Λοφία, Gutturalis.

† Μασχαλιστὴρ.

‡ Ἀῤῥεπὴς, in neutram partem inclinans.

‖ Διαζωστὴρ, præcingens.

may be proper now to remark, that the Ligaments which ſerve that Articulation, aſſiſt in connecting the *Vertebræ*.

The loweſt Order of the *true Vertebræ* is the *Lumbar* *, which are five Bones, that may be diſtinguiſhed from any others by theſe Marks: 1. Their Bodies, though of a circular Form at their Fore-part, are ſomewhat oblong from one Side to the other; which may be occaſioned by the Preſſure of the large Veſſels, the *Aorta* and *Cava*, and of the *Viſcera*. The *Epiphyſes* on their Edges are larger, and therefore the upper and lower Surfaces of their Bodies are more concave, than in the *Vertebræ* of the Back. 2. The Cartilages between theſe *Vertebræ* are much the thickeſt of any, and render the Spine convex within the *Abdomen*, by their greateſt Thickneſs being at their Fore-part. 3. The oblique Proceſſes are ſtrong and deep; thoſe in oppoſite Sides being almoſt placed in parallel Planes; the ſuperior, which are concave, facing inwards, and the convex inferior ones facing outwards. and therefore each of theſe *Vertebræ* receives the one above it, and is received by the one below; which is not ſo evident in the other two claſſes already deſcribed. 4. Their tranſverſe Proceſſes are ſmall, long, and almoſt erect, for allowing large Motion to each Bone, and ſufficient Inſertion to Muſcles, and for ſupporting and defending the internal Parts. 5. Betwixt the Roots of the ſuperior oblique and tranſverſe Proceſſes, a ſmall Protuberance may be obſerved, where ſome of the Muſcles that raiſe the Trunk of the Body are inſerted. 6. Their ſpinal Proceſſes are ſtrong, ſtreight, and horizontal, with broad flat Sides, and a narrow Edge above and below; this laſt being depreſſed on each Side by Muſcles. And at the Root of theſe Edges, we ſee rough Surfaces for fixing the Ligaments. 7. The Canal for the numerous Cords, called *Cauda equina*, into which the ſpinal Marrow divides, is rather larger in theſe Bones, than what contains that *Marrow* in the *Vertebræ* of the Back. 8. The Holes for the Paſſage of the Nerves are more equally formed out of both the contiguous *Vertebræ* than in the other Claſſes; the upper one furniſhes however the larger ſhare of each Hole.

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* Οσφύος, ἰξὺος, ψοιῶν, Renum, Lumborum.

The thick Cartilages between theſe *lumbar Vertebræ*, their deep oblique Proceſſes, and their erect ſpinal Proceſſes, are all fit for allowing large Motion; though it is not ſo great as what is performed in the Neck; which appears from comparing the Arches which the Head deſcribes when moving on the Neck, or the Loins only.

The *lumbar Vertebræ* as they deſcend, have their oblique Proceſſes at a greater Diſtance from each other, and facing more backwards and forwards.

Both tranſverſe and ſpinal Proceſſes of the middlemoſt *Vertebra* of the Loins are longeſt and thickeſt; in the *Vertebræ* above and below they are leſs: So that theſe Proceſſes of the firſt* [illegible] and fifth † are the leaſt, to prevent their ſtriking on the Ribs or *Oſſa Iliûm*, or their bruiſing the Muſcles in the Motions of the Spine.

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* Νεφριτης, tenalis.

The *Epiphyſes* round the Edges of the Bodies of the *lumbar Vertebræ* are moſt raiſed in the two loweſt, which conſequently make them appear hollower in the middle than the others are.

The Body of the fifth *Vertebra* is rather thinner than that of the fourth.——The ſpinal Proceſs of this fifth is ſmaller, and the oblique Proceſſes face more backwards and forwards than in any other *lumbar Vertebra.*

After conſidering the Structure of the particular *Vertebrae*, and their mutual Connexion, we may obſerve a ſolicitous Care taken that they ſhall not be disjoined, but with great Difficulty; for, beſides being connected by ſtrong Ligaments proportioned to the Forces which are to be reſiſted; their Bodies either enter ſo into each other, as to prevent their being diſplaced any Way, as in the *Vertebrae* of the Neck; or they are proped on all Sides, as theſe of the *Back* are by the Ribs; or their Surfaces of Contact are ſo broad, as to render the Separation almoſt impracticable, as in the *Loins*; while the Depth and Articulation of the oblique Proceſſes are exactly proportioned to the Quantity of Motion, which the other Parts of the Bones allow, or the Muſcles can perform: Yet, as theſe oblique Proceſſes are ſmall, and therefore not capable of ſo ſecure a Conjunction as the larger Bodies, they may ſooner yield to a disjoining Force; but then their diſlocation is not of near ſo bad Conſequence as the Separation of the Bodies would be: For, by the oblique Proceſſes being diſlocated, the Muſcles, Ligaments, and *ſpinal* Marrow are indeed ſtretched; but this Marrow muſt be compreſſed, or entirely deſtroyed when the Body of the *Vertebra* is removed out of its Place.

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† Ἀσχαλὶτης, fulciens.

The *FALSE VERTEBRAE* compoſe the under Pyramid of the *Spine*. They are diſtinguiſhed from the Bones already deſcribed juſtly enough by this Epithet of *falſe*; becauſe, tho' each Bone into which they can be divided in young People, reſembles the *true Vertebræ* in Figure, yet none of them contribute to the Motion of the Trunk of the Body; they being intimately united to each other in Adults, except at their lower Part, where they are moveable; whence they are commonly divided into two Bones, *Os ſacrum*, and *Coccygis*.

OS SACRUM *, is ſo called, from being offered in Sacrifice by the Ancients, or rather becauſe of its Largeneſs in Reſpect of the other *Vertebræ*. —— This Bone is of an irregular triangular Shape, broad above, narrow below, convex behind, for the advantageous Origin of the Muſcles that move the *Spine* and Thigh backwards; and concave before, for enlarging the Cavity of the *Pelvis*. —— Four tranſverſe Lines of a Colour different from the reſt of the Bone which are ſeen on its Fore-part, are the Marks of Diviſion of the five different Bones of which it conſiſts in young Perſons.

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* Ἱερὸν, σπονδυλος μὲγας Hippocrat. ὗποσπονδυλον, Oribas. Πλατυ, Latum, Os clunium, Clavium.

The Fore-part of the *Os ſacrum*, analogous to the Bodies of the *true Vertebræ*, is ſmooth and flat, to allow a larger Space for the contained Bowels, without any Danger of hurting them; or this flat Figure may be owing to the equal Preſſure of theſe Bowels, particularly of the laſt Gut.——The back Part of it is almoſt ſtreight, without ſo large a Cavity as the *Vertebræ* have; becauſe the ſpinal Marrow, now ſeparated into the *Cauda equina*, is ſmall.——The Bridges between the Bodies and Proceſſes of this Bone, are much thicker, and in Proportion ſhorter, than in the former Claſs of Bones.——The Strength of theſe croſs Bridges is very remarkable in the three upper Bones, and is well proportioned to the incumbent Weight of the Trunk of the Body, which theſe Bridges ſuſtain in a tranſverſe, conſequently an unfavourable, Situation, when the Body is erect.

There are only two oblique Proceſſes of the *Os ſacrum*; one ſtanding out on each Side from the upper Part of the firſt Bone.——Their plain erect Surfaces face backwards, and are articulated with the inferior oblique Proceſſes of the laſt *Vertebra* of the Loins, to which each of theſe Proceſſes is connected by a ſtrong Ligament, which riſes from a ſcabrous Cavity round their Roots, where mucilaginous Glands are alſo lodged.—Inſtead of the other oblique Proceſſes of this Bone, four rough Tubercles are to be ſeen on each Side of its Surface behind, from which the *Muſculus ſacer* has its Origin.

The tranſverſe Proceſſes here are all grown together into one large ſtrong oblong Proceſs on each Side; which, ſo far as it anſwers to the firſt three Bones, is very thick, and divided into two irregular Cavities, by a long perpendicular Ridge. —— The foremoſt of the two Cavities has commonly a thin cartilaginous Skin covering it in the recent ſubject, and is adapted to the unequal Protuberance of the *Os Iliûm*, and a ſtrong Ligament connects the Circumference of theſe Surfaces of the two Bones.—— The Cavity behind is divided by a tranſverſe Ridge into two, where ſtrong ligamentous Strings that go from this Bone to the *Os Iliúm* with a cellular Subſtance containing *Mucus*, are lodged.

The tranſverſe Proceſſes of the two laſt Bones of the *Os ſacrum* are much ſmaller than the former.——At their Back-part near their Edge, a Knob and oblong flat Surface give riſe to two ſtrong Ligaments which are extended to the *Os Iſchium*; and are therefore called *ſacroſciatic*.

The ſpinal Proceſſes of the three uppermoſt Bones of the *Os ſacrum*, appear ſhort, ſharp, and almoſt erect, while the two lower ones are open behind; and ſometimes a little Knob is to be ſeen on the fourth, though generally it is bifurcated, without the two Legs meeting into a Spine; in which Condition alſo the firſt is often to be ſeen; and ſometimes none of them meet, but leave a *Sinus*, or rather *Foſſa*, inſtead of a Canal (*a*) — The *Muſculus latiſſimus* and *longiſſimus Dorſi*, *Sacrolumbalis*, and *Glutaeus maximus*, have Part of their Origins from theſe ſpinal Proceſſes.

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(*a*) *Verbeyen*, Anat. Tract. 5. cap. 9.

The Canal between the Bodies and Proceſſes of this Bone, for the *Cauda equina*, is triangular; and becomes ſmaller as it deſcends, as the *Cauda* alſo does.——Below the third Bone, this Paſſage is no more a compleat bony Canal, but is open behind; and is only there defended by a ſtrong ligamentous Membrane ſtretched over it, which, with the Muſcles that cover it, and are very prominent on each Side, is a ſufficient Defence for the Bundle of Nerves within.

At the Root of each oblique Proceſs of this Bone, the Notch is conſpicuous by which, and ſuch another in the laſt *Vertebra* of the Loins, a Paſſage is left for the twenty fourth ſpinal Nerve; and, in viewing the *Os ſacrum*, either before or behind, four large Holes appear in each Side, in much the ſame Height, as where the Marks of the Union of its ſeveral Bones remain. Some of the largeſt Nerves of the Body, paſs through the anterior Holes; and ſuperficial Grooves running outwards from them in different Directions, ſhew the Courſe of theſe Nerves—From the Intervals of theſe Grooves, the *Pyriformis* Muſcle chiefly riſes.——The Holes in the back Part of the Bone are covered by Membranes which allow ſmall Nerves to paſs through them.——The two uppermoſt of theſe Holes, eſpecially on the Fore-ſide, are the largeſt; and as the Bone deſcends, the Holes turn ſmaller. Sometimes a Notch is only formed at the lower Part in each Side of this Bone; and in other Subjects there is a Hole common to it and the *Os Coccygis*, through which the twenty ninth Pair of ſpinal Nerves paſſes; and frequently a bony Bridge is formed on the back

Part of each Side by a Proceſs ſent up from the back Part of the *Os Coccygis*, and joined to the little Knobs which the laſt Bone of the *Os ſacrum* has inſtead of a Spinal Proceſs. Under this Bridge, or *Jugum*, the twenty ninth Pair of ſpinal Nerves runs in its Courſe to the common Holes juſt now deſcribed.

The upper Part of the Body of the firſt Bone reſembles the *Vertebrae* of the Loins; but the ſmall fifth Bone is oblong tranſverſely, and hollow in the Middle of its lower Surface.

The Subſtance of the *Os ſacrum* is very ſpongy, without any conſiderable ſolid external Plates, and is lighter proportionally to its Bulk than any other Bone in the Body; but is ſecured from Injuries by the thick Muſcles that cover it behind, and by the ſtrong ligamentous Membranes that cloſely adhere to it.—— As this is one of the moſt remarkable Inſtances of this Sort of Defence afforded a ſoft weak Bone, we may make the general Obſervation, That, where-ever we meet with ſuch a Bone, one or other, or both theſe Defences are made uſe of; the firſt to ward off Injuries, and the ſecond to keep the Subſtance of the Bone from yielding too eaſily.

This Bone is articulated above to the laſt *Vertebra* of the Loins, in the Manner that the *Lumbar Vertebræ* are joined; and therefore the ſame Motions may be performed here.—— The Articulation of the lower Part of the *Os ſacrum* to the *Os Coccygis* ſeems well enough adapted for allowing conſiderable Motion to this laſt Bone, was it not much confined by Ligaments.—Laterally, the *Os ſacrum* is joined to the *Oſſa Iliûm* by an immoveable *Synchondroſis*, or what almoſt deſerves the Name of a Suture; for the cartilaginous Cruſt on the Surface of the Bones is very thin, and both their Surfaces are ſo ſcabrous and unequal, as to be indented into each other; which makes ſuch a ſtrong Connexion, that great Force is required to ſeparate them, after all the Muſcles and Ligaments are cut. —— Frequently the two Bones grow together in old Subjects.

The Uſes of the *Os ſacrum* are, to ſerve as the common Baſe and ſupport of the Trunk of the Body, to guard the Nerves proceeding from the End of the ſpinal Marrow, to defend the back Part of the *Pelvis*, and to afford ſufficient Origin to the Muſcles which move the Trunk and Thigh.

The Bones that compoſe the *Os ſacrum* of Infants, have their Bodies ſeparated from each other by a thick Cartilage; and, in the ſame Manner as the *true Vertebræ*, each of them conſiſts of a Body and two lateral Plates, connected together by Cartilages; the Ends of the Plates ſeldom being contiguous behind.

OS COCCYGIS *, or *Rump-bone*, is that triangular Chain of Bones depending from the *Os ſacrum*; each Bone becoming ſmaller as they deſcend, till the laſt ends almoſt in a Point. The *Os Coccygis* is convex behind, and concave before; from which crooked pyramidal Figure which was thought to reſemble a Cuckow's Beak, it has got its Name.

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* Ὀῤῥοπυγιον, ὄῤῥος, Caudæ os, Spondylium, Os Cuculi.

This Bone conſiſts of four Pieces in People of middle Age:——In Children, very near the whole of it is Cartilage: In old Subjects, all the Bones are united, and become frequently one continued Bone with the *Os ſacrum.*

The higheſt of the four Bones is the largeſt, with Shoulders extended farther to each Side than the End of the *Os ſacrum;* which Enlargement ſhould, in my Opinion, ſerve as a diſtinguiſhing Mark to fix the Limits of either Bone; and therefore ſhould take away all Diſpute about reckoning the Number of Bones, of which one or other of theſe two Parts of the *falſe Vertebræ*, is compoſed; which Diſpute muſt ſtill be kept up, ſo long as the numbering five or ſix Bones in the *Os ſacrum* depends upon the uncertain Accident of this broad-ſhouldered little Bone being united to, or ſeparated from it.——The upper Surface of this Bone is a little hollow.——From the Back of that bulbous Part called its *Shoulders*, a Proceſs often riſes up on each Side, to join with the bifurcated Spine of the fourth and fifth Bones of the *Os ſacrum*, to form the bony Bridge mentioned in the Deſcription of the *Os ſacrum.*—Sometimes theſe Shoulders are joined to the Sides of the fifth Bone of the *Os ſacrum*, to form the Hole in each Side common to theſe two Bones, for the Paſſage of the twenty ninth Pair of ſpinal Nerves.——Immediately below the Shoulders of the *Os Coccygis*, a Notch may be remarked in each Side, where the thirtieth Pair of the ſpinal Nerves paſſes.——The lower End of this Bone is formed into a ſmall Head, which very often is hollow in the Middle.

The three lower Bones gradually become ſmaller, and are very ſpongy; but are ſtrengthened by a ſtrong Ligament which covers and connects them.——Their Ends, by which they are articulated, are formed in the ſame Manner as thoſe of the firſt Bone are.

Between each of theſe four Bones of young Subjects a Cartilage is interpoſed; therefore their Articulation is analogous to that of the Bodies of the *Vertebræ* of the Neck: For, as has been above remarked, the lower End of the *Os ſacrum*, and of each of the three ſuperior Bones of the *Os Coccygis* has a ſmall Depreſſion in the Middle; and the upper Part of all the Bones of the *Os Coccygis* is a little concave, and conſequently the interpoſed Cartilages are thickeſt in the Middle, to fill up both Cavities; by which they connect the Bones more firmly.—When the Cartilages oſſify, the upper End of each Bone is formed into a Cavity, exactly adapted to the protuberant lower End of the Bone immediately above.—From this ſort of Articulation, it is evident, that, unleſs when theſe Bones grow together, all of them are capable of Motion; of which, the firſt and ſecond, eſpecially this laſt, enjoys the largeſt Share.

The lower End of the fourth Bone terminates in a rough Point, to which a Cartilage is appended.

To the Sides of theſe Bones of the *Os Coccygis*, the *Coccygæi* Muſcles (*a*), and Part of the *Levatores Ani*, and of the *Glutaei maximi*, are fixed.

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(*a*) *Douglas*, Myograph. chap. 40.——*Euſtach.* Tab. 36, No. 45. 20.

The Subſtance of theſe Bones is very ſpongy, and in Children cartilaginous; there being only a Part of the firſt Bone oſſified in a new-born Infant.—Since therefore the *Inteſtinum rectum* of Children is not ſo firmly ſupported as it is in *Adults*, this may be one reaſon why they are more ſubject to a *Procidentia Ani* than old People (*a*).

From the Deſcription of this Bone, we ſee how little it reſembles the *Vertebræ*, ſince it ſeldom has Proceſſes, never has any Cavity for the *ſpinal* Marrow, nor Holes for the Paſſage of Nerves.—Its Connexion hinders it to be moved to either Side; and its Motion backwards and forwards is much confined: Yet, as its Ligaments can be ſtretched by a conſiderable Force, it is a great Advantage in the Excretion of the *Fœces alvinæ*, and much more in Child-bearing, that this Bone ſhould remain moveable; and the right Management of it, in delivering Women, may be of great Benefit to them (*b*).——The Mobility of the *Os Coccygis* diminiſhing as People advance in Age, eſpecially when its Ligaments and Cartilages have not been kept flexible by being ſtretched, is probably one Reaſon why the Women, who are old Maids before they marry, have generally hard labour in Child-bed.

The *Os Coccygis* ſerves to ſuſtain the *Inteſtinum rectum*; and, in order to perform this Office more effectually, it is made to turn with a

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(*a*) *Spigel.* de humani corp. fabric. lib. 2. cap. 22.——*Paaw*, de Oſſib. pars 2. cap. 3.

(*b*) *Paaw*, ibid.——*Deventer*. Operat. Chirurg. cap. 27.

Curve forwards, by which alſo the Bone itſelf, as well as the Muſcles and Teguments, is preſerved from any Injury, when we ſit with our Body reclined back.

The ſecond Part of the Trunk of the Skeleton, the *PELVIS*, is the cylindrical Cavity at the lower Part of the *Abdomen*, formed by the *Os ſacrum*, *Os Coccygis*, and *Oſſa innominata*; which laſt therefore fall now in Courſe to be examined.

Though the Name of *OSSA INNOMINATA*[*] contributes nothing to the Knowledge of their Situation, Structure, or Office; yet they have been ſo long and univerſally known by it, that there is no Occaſion for changing it.—They are two large broad Bones, which form the Fore-part and Sides of the *Pelvis*, and the lower Part of the Sides of the *Abdomen*.—In Children each of theſe Bones is evidently divided into three; which are afterwards ſo intimately united, that ſcarce the leaſt Mark of their former Separation remains: This notwithſtanding, they are deſcribed as conſiſting each of three Bones, to wit, the *Os Iliûm*, *Iſchiûm*, and *Pubis*; which I ſhall firſt deſcribe ſeparately, and then ſhall conſider what is common to any two of them, or to all the three.

OS ILIUM [†], or *Haunch bone*, is ſituated higheſt of the three, and reaches as far down as one third of the great Cavity, into which the Head of the Thigh-bone is received.

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[*] Σκελίων, προσφύσεις, Sacro conjuncta.

[†] Λαγόνων, κενεὸν, Scaphium, lumbare, clunium, clavium, anchas.

The external Side of this Bone is unequally convex, and is called its *Dorſum;*—the internal concave Surface is by ſome (but improperly) named its *Coſta.*——The ſemicircular Edge at the higheſt Part of this Bone, which is tipped with a Cartilage in the recent Subject, is named the *Spine,* into which the external, or deſcending oblique Muſcle of the *Abdomen,* is inſerted; and from it the internal aſcending oblique and the tranſverſe Muſcles of the Belly, with the *Glutæus maximus, Quadratus lumborum,* and *latiſſimus Dorſi,* have their Origin. Some (*a*) are of Opinion, that it is only the tendinous Cruſt of all theſe Muſcles, and not a Cartilage, as commonly alledged, that covers this bony Edge.—The Ends of the Spine are more prominent than the Surface of the Bone below them; therefore are reckoned Proceſſes.——From the anterior ſpinal Proceſs, the *Sartorius* and *Faſcialis* Muſcles have their Riſe, and the outer End of the doubled Tendon of the external oblique Muſcle of the *Abdomen,* commonly called *Fallopius*'s or *Poupart*'s Ligament, is fixed to it.——The Inſide of the poſterior ſpinal Proceſs, and of Part of the Spine forward from that, is made flat and rough where the *Sacro-lumbalis* and *longiſſimus Dorſi* riſe; and to ts outſide Ligaments, extended to the *Os ſacrum* and tranſverſe Proceſſes of the fifth and fourth *Vertebra* of the Loins, are fixed (*b*).——Below the anterior ſpinal Proceſs another Protuberance

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(*a*) *Winſlow,* Expoſition Anatomique du corps humain, Traitè des Os frais, §. 96.

(*b*) *Weithrecht.* Syndeſmolog. Sect. 4. §. 39. 40. 46. 47.

tuberance ſtands out, which, by its Situation, may be diſtinguiſhed from the former, by adding the Epithet of *inferior*, where the *Muſculus rectus Tibiæ* has its Origin (*a*).—Betwixt theſe two anterior Proceſſes the Bone is hollowed, where the Beginning of the *Sartorius* Muſcle is lodged.—Below the poſterior ſpinal Proceſs, a ſecond Protuberance of the Edge of this Bone is in like Manner obſervable, which is cloſely applied to the *Os ſacrum.*—Under this laſt Proceſs a conſiderable large Niche is obſervable in the *Os Iliûm;* between the Sides of which and the ſtrong Ligament that is ſtretched over from the *Os ſacrum* to the ſharp-pointed Proceſs of the *Os Iſchiûm* of the recent Subject, a large Hole is formed, through which the *Muſculus-pyriformis*, the great ſciatic Nerve, and the poſterior crural Veſſels paſs, and are protected from Compreſſion.

The external broad Side or *Dorſum* of the *Os Iliûm* is a little hollow towards the Forepart; farther back it is as much raiſed; then is conſiderably concave; and, laſtly, it is convex. Theſe Inequalities are occaſioned by the Actions of the Muſcles that are ſituated on this Surface.—From behind the uppermoſt of the two anterior ſpinal Proceſſes, in ſuch Bones as are ſtrongly marked by the Muſcles, a ſemicircular Ridge is extended to the hollow Paſſage of the ſciatic Nerve. Between the Spine and this Ridge the *Glutæus medius* takes its Riſe. Immediately from above the loweſt of the anterior ſpinal Proceſſes, a ſecond Ridge is

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(*a*) *Baker*, Curſ. Oſteolog. demonſtr. 3.

is ſtretched to the Niche. Between this and the former Ridge, the *Glutæus minimus* has its Origin.——On the Outſide of the poſterior ſpinal Proceſſes, the *Dorſum* of the *Os Iliûm* is flat and rough, where Part of the *Muſculus Glutæus maximus* and *pyriformis* riſes.—The loweſt Part of this Bone is the thickeſt, and is formed into a large Cavity with high Brims, to aſſiſt in compoſing the great *Acetabulum;* which ſhall be conſidered, after all the three Bones that conſtitute the *Os Innominatum* are deſcribed.

The internal Surface of the *Os Iliûm* is concave in its broadeſt Fore-part, where the internal Iliac Muſcle has its Origin, and ſome Share of the *Inteſtinum Iliûm* and *Colon* is lodged.——From this large Hollow a ſmall Sinuoſity is continued obliquely forwards, at the Inſide of the anterior inferior ſpinal Proceſs, where Part of the *Pſoas* and *Iliacus* Muſcles, with the crural Veſſels and Nerves, paſs.——The large Concavity is bounded below by a ſharp Ridge, which runs from behind forwards; and, being continued with ſuch another Ridge of the *Os Pubis*, forms a Line of Partition between the *Abdomen* and *Pelvis.*——Into this Ridge the broad Tendon of the *Pſoas parvus* is inſerted.

All the internal Surface of the *Os Iliûm*, behind this Ridge, is very unequal: For the upper Part is flat, but ſpongy, where the *Sacrolumbalis* and *longiſſimus Dorſi* riſe.——Lower down there is a tranſverſe Ridge, from which Ligaments go out to the *Os ſacrum.*——Immediately below this Ridge the rough unequal Cavities and Prominences are placed, which are exactly adapted to thoſe deſcribed on the Side of the *Os ſacrum.*——In the ſame Manner the upper Part of this rough Surface is porous, for the firmer Adheſion of the ligamentous cellular Subſtance; while the lower Part is more ſolid, and covered with a thin cartilaginous Skin, for its immoveable Articulation with the *Os ſacrum.*——From all the Circumference of this large unequal Surface, Ligaments are extended to the *Os ſacrum*, to ſecure more firmly the Conjunction of theſe Bones.

The Paſſages of the medullary Veſſels are very conſpicuous, both in the *Dorſum* and *Coſta* of many *Oſſa Iliûm*; but in others they are inconſiderable.

The poſterior and lower Parts of theſe Bones are thick; but they are generally exceeding thin and compact at their Middle, where they are expoſed to the Actions of the *Muſculi glutæi* and *Iliacus internus*, and to the Preſſure of the Bowels contained in the Belly.——The Subſtance of the *Oſſa Iliûm* is moſtly cellular, except a thin external Table.

In a ripe Child the Spine of the *Os Iliûm* is cartilaginous, and is afterwards joined to the Bone in form of an *Epiphyſe.*——The large lower End of this Bone is not compleatly oſſified.

OS ISCHIUM * or *Hip-bone*, is of a middle Bulk between the two other Parts of the *Os innominatum*, is ſituated loweſt of the three, and is of a very irregular Figure.——Its extent might be marked by an horizontal Line drawn near through the Middle of the *Acetabulum;* for the upper bulbous Part of this Bone forms ſome leſs than the lower Half of that great Cavity, and the ſmall Leg of it riſes to much the ſame Height on the other Side of the great Hole common to this Bone and the *Os Pubis.*

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* Coxæ, coxendicis, pixis.

From the upper thick Part of the *Os Iſchium* a ſharp Proceſs, called by ſome *ſpinous*, ſtands out backwards, from which chiefly the *Muſculus coccygæus* and *ſuperior Gemellus*, and Part of the *Levator Ani*, riſe; and the anterior or nternal *Sacroſciatic* Ligament is fixed to it.——Between the upper Part of this Ligament and he Bones, it was formerly obſerved that the *yriform* Muſcle, the poſterior crural Veſſels, nd the Sciatic Nerve, paſs out of the *Pelvis.*—mmediately below this Proceſs, a Sinuoſity is ormed for the Tendon of the *Muſculus obturator internus.*—In a recent Subject, this Part of he Bone, which ſerves as a Pulley on which he *Obturator* Muſcle plays, is covered with a igamentous Cartilage, that, by two or three mall Ridges, points out the Interſtices of the Fibres in the Tendon of this Muſcle.——The uter Surface of the Bone at the Root of this pinous Proceſs is made hollow by the *Pyriformis* or *Iliacus externus* Muſcle.

Below the Sinuoſity for the *Obturator* Muſcle, is the great Knob or *Tuberoſity*, covered with Cartilage or Tendon (*a*).——The pper Part of the Tuberoſity gives Riſe to the inferior

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(*a*) *Winſlow*. Expoſit. Anat. des Os frais, § 96.

inferior *Gemellus* Muſcle.——To a Ridge the Inſide of this, the external or poſteri *ſacroſciatic* Ligament is ſo fixed, that betwee it, the internal Ligament and the Sinuoſity the *Os Iſchiûm*, a Paſſage is left for the inte nal *obturator* Muſcle.——The upper thic ſmooth Part of the *Tuber*, called by ſome i *Dorſum*, has two oblique Impreſſions on i The inner one gives Origin to the long He of the *Biceps flexor Tibiæ* and *ſeminervoſ* Muſcles, and the *Semimembranoſus* riſes fro the exterior one, which reaches higher an nearer the *Acetabulum* than the other——Th lower thinner more ſcabrous Part of the Kn which bends forwards, is alſo marked with tw flat Surfaces, whereof the internal is what w lean upon in ſitting, and the external giv Riſe to the largeſt Head of the *Triceps adduct femoris*.——Between the external Margin the Tuberoſity and the great Hole of the *innominatum*, frequently there is an obtu Ridge extended down from the *Acetabulu* which gives Origin to the *Quadratus femor* ——As the *Tuber* advances forwards, it becom ſmaller, and is rough, for the Origin of th *Muſculus tranſverſalis* and *Erector Penis*.— The ſmall Leg of it, which mounts upwar to join the *Os Pubis*, is rough and promine at its Edge, where the two lower Heads of th *Triceps* or *Quadriceps adductor femoris* tak their Riſe.

The upper and back Part of the *Os Iſchiû* is broad and thick; but its lower and for Part is narrower and thinner.——Its Subſtan is of the Structure common to broad Bones.

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The *Os Iliûm* and *Pubis* of the ſame Side, are the only Bones which are contiguous to the *Os Iſchiûm.*

The Part of the *Os Iſchiûm* which forms the *Acetabulum*, the ſpinous Proceſs, the great *Tuber*, and the recurved Leg, are all cartilaginous at Birth.——The *Tuber* with part of the Leg or Proceſs above it becomes an Epiphyſe before this Bone is fully formed.

The *OS PUBIS* *, or *Share-bone*, is the leaſt of the three Parts of the *Os innominatum*, and is placed at the upper Fore-part of it.——The thick largeſt Part of this Bone is employed in forming the *Acetabulum;* from which becoming much ſmaller, it is ſtretched inwards to its fellow of the other Side, where again it grows larger, and ſends a ſmall Branch downwards to join the End of the ſmall Leg of the *Os Iſchiûm.*——The upper Fore-part of each *Os Pubis* is tuberous and rough where the *Muſculus rectus* and *pyramidalis* are inſerted. ——From this a Ridge is extended along the ipper Edge of the Bone, in a continued Line vith ſuch another of the *Os Iliûm*, which divides the *Abdomen* and *Pelvis*. The Ligament f *Fallopius* is fixed to the internal End of this Ridge, and the ſmooth Hollow below it is nade by the *Pſoas* and *Iliacus internus* Muſcles aſſing with the anterior crural Veſſels and Nerves behind the Ligament.——Some way elow the former Ridge, another is extended rom the tuberous Part of the *Os Pubis* downvards and outwards towards the *Acetabulum;*

S between

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* [illegible]

between theſe two Ridges the Bone is hollow and ſmooth, for lodging the Head of the *Pectineus* Muſcle.——Immediately below, where the lower Ridge is to take the Turn downwards, a winding Niche is made, which is comprehended in the great *Foramen* of a Skeleton, but is formed into a Hole by a ſubtended Ligament in the recent Subject, for the Paſſage of the poſterior crural Nerve, an Artery and a Vein.——The internal End of the *Os Pubis* is rough and unequal, for the firmer Adheſion of the thick ligamentous Cartilage that connects it to its Fellow of the other Side: ——The Proceſs which goes down from that to the *Os Iſchiûm* is broad and rough before where the *Gracilis* and upper Heads of the *Triceps*, or rather *Quadriceps adductor femoris* have their Origin.

The Subſtance of the *Os Pubis* is the ſame as of other broad Bones.

Only a Part of the large End of this Bone is oſſified; and the whole Leg is cartilaginous in a Child born at the full Time.

Betwixt the *Os Iſchiûm* and *Pubis* a very large irregular Hole is left, which, from its Reſemblance to a Door or Shield, has been called *Thyroides*. This Hole is all, except the Nitch for the poſterior crural Nerve, filled up in a recent Subject with a ſtrong ligamentous Membrane, that adheres very firmly to its Circumference. From this Membrane chiefly the two *Obturatores*, external and internal take their Riſe.——The great Deſign of this Hole, beſides rendering the bone lighter, is to allow a ſtrong enough Origin to the *obtura*

to

tor Muſcles, and ſufficient Space for lodging their Bellies, that there may be no Danger of diſturbing the Functions of the contained *Viſcera* of the *Pelvis* by the Actions of the internal, nor of the external being bruiſed by the Thigh-bone, eſpecially by its leſſer *Trochanter*, in the Motions of the Thigh inwards: Both which Inconveniencies muſt have happened, had the *Oſſa innominata* been compleat here, and of ſufficient Thickneſs and Strength to ſerve as the fixed Point of theſe Muſcles.—— The Bowels ſometimes make their Way thro' the Nitch for the Veſſels, at the upper Part of this *thyroid* Hole, and this cauſes a *Hernia* in this Place *(a)*.

In the external Surface of the *Oſſa innominata*, near the Outſide of the great Hole, a large deep Cavity is formed by all the three Bones conjunctly: For the *Os Pubis* conſtitutes about one Fifth; the *Os Iliûm* makes ſomething leſs than two Fifths, and the *Os Iſchiûm* as much more than two Fifths. The Brims of this Cavity are very high, and are ſtill much more enlarged by the ligamentous Cartilage, with which they are tipped in a recent Subect. From this Form of the Cavity it has been called *Acetabulum*; and, for a diſtinguiſhing Character, the name of the Bone that contitutes the largeſt Share of it is added; therefore *Acetabulum oſſis Iſchii* * is the Name this Cavity commonly bears.——Round the Baſe

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(a) Memoires de l'Acad. de Chirurgie, tom. 1. p. 709. &c.

* Coxæ, Coxendicis.

of the *Supercilia* the Bone is rough and unequal, where the *capſular* Ligament of the Articulation is fixed.——The Brims at the Upper and Back part of the *Acetabulum* are much larger and higher than any where elſe; which is very neceſſary to prevent the Head of the *Femur* from ſlipping out of its Cavity at this Place, where the whole Weight of the Body bears upon it, and conſequently would otherwiſe be conſtantly in danger of thruſting it out. ——As theſe Brims are extended downwards and forwards, they become leſs; and at their internal lower Part a Breach is made in them; from the one Side of which to the other, a Ligament is placed in the recent Subject; under which a large Hole is left, which contains a fatty cellular Subſtance and Veſſels. The Reaſon of which Appearance has afforded Matter of Debate. To me it ſeems evidently contrived for allowing a larger Motion to the Thigh inwards: For if the bony Brims had been here continued, the Neck of the Thigh-bone muſt have ſtruck upon them when the Thighs were brought acroſs each other; which, in a large ſtrong Motion this Way, would have endangered the Neck of the one Bone, or Brim of the other. Then the Veſſels which are diſtributed to the Joint may ſafely enter at the Sinuoſity in the Bottom of the Breach; which being however larger than is neceſſary for that Purpoſe, allows the large mucaginous Gland of the Joint to eſcape below the Ligament, when the Head of the Thigh-bone is in Hazard of preſſing too much upon it in the

Motions of the Thigh outwards (*a*)——Beſides this Difference in the Height of the Brims, the *Acetabulum* is otherwiſe unequal: For the lower internal Part of it is depreſſed below the cartilaginous Surface of the Upper-part, and is not covered with Cartilage; into the Upper-part, of this particular Depreſſion where it is deepeſt, and of a ſemilunar Form, the Ligament of the Thigh-bone, which is commonly, though improperly, called the *round* one, is inſerted; while in its more ſuperficial lower Part the large mucilaginous Gland of this Joint is lodged. The largeſt Share of this ſeparate Depreſſion is formed in the *Os Iſchium*.

From what has been ſaid of the Condition of the three Bones compoſing this *Acetabulum* in new-born Children, it muſt be evident, that a conſiderable Part of this Cavity is cartilaginous in them.

The *Oſſa innominata* are joined at their Back-part to each Side of the *Os ſacrum* by a ſort of Suture, with a very thin interveening Cartilage, which ſerves as ſo much Glue to cement theſe Bones together; and ſtrong Ligaments go from the Circumference of this unequal Surface, to connect them more firmly. The *Oſſa innominata* are connected together at their Fore-part by the thick firm Cartilage interpoſed between the two *Oſſa Pubis*.——Theſe Bones can therefore have no Motion in a natural State, except what is common to the Trunk of the Body, or to the *Os ſacrum*. But it has been diſputed, whether or not they looſen ſo much from each other,

and

(*a*) *Petit*, Memoires de l'Acad. des Sciences, 1722.

and from the *Os ſacrum* in Child-birth, by the Flow of *Mucus* to the *Pelvis*, and by the Throws of the Labour, as that the *Oſſa Pubis* recede from each other, and thereby allow the Paſſage between the Bones to be enlarged.—Several Obſervations (*a*) ſhew that this Relaxation ſometimes happens: But thoſe who had frequently Opportunities of diſſecting the Bodies of Women who died immediately after being delivered of Children, teach us to beware of regarding this as the common Effect of Child-birth; for they found ſuch a Relaxation in very few of the Bodies which they examined (*b*).

Conſidering what great Weight is ſupported in our erect Poſture, by the Articulation of the *Oſſa innominata* with the *Os ſacrum*, there is great Reaſon to think, that if the conglutinated Surfaces of theſe Bones were once ſeparated, (without which, the *Oſſa Pubis* cannot ſhuffle on each other) the Ligaments would be violently ſtretched, if not torn; from whence many Diſorders would ariſe (*c*).

Each *Os innominatum* affords a Socket (the *Acetabulum)* for the Thigh-bones to move in, and the Trunk of the Body rolls here on the Heads of the Thigh-bones.—This Articulation is to be more fully deſcribed after the *Oſſa femoris* are examined.

The

(*a*) *Bauhin*. Theat. Anat. lib. 1. cap. 49.—*Spigel.* Anat. lib. 2. cap. 24.—*Riolan*. Anthropogr. lib. 6. cap. 12.—*Diemerbroeck*, Anat. lib. 9. cap. 16.

(*b*) *Hildan*. Epiſt. Cent. obſ. 46.—*Dionis*. Sixieme Demonſtr. des Os.—*Morgagn*. Adverſ. 3. Auimad. 15.

(*b*) *Ludov.* in Ephem. German. Dec. 1. ann. 3. obſ. 254.

The *Pelvis* then has a large Open above where it is continued with the *Abdomen*, is ſtrongly fenced by Bones on the Sides, Back, and Fore-part, and appears with a wide Opening below, in the Skeleton; but, in the recent Subject, a conſiderable Part of the Opening is filled by the *Sacroſciatic* Ligaments, *Pyriform, internal obturator*, *Levatores ani*, *Gemini* and *Coccygæi* Muſcles, which ſupport and protect the contained Parts better than Bones could have done; ſo hat Space is only left at the loweſt Part of t, for the large Excretories, the *Veſica urinaria*, *Inteſtinum rectum*, and, in Females, the *Uterus*, to diſcharge themſelves.

The *THORAX* †, or *Cheſt*, which is the only Part of the Trunk of the Body which we have not yet deſcribed, reaches from below the Neck to the Belly; and, by means of the Bones hat guard it, is formed into a large Cavity: The Figure of which is ſomewhat conoidal; but ts upper ſmaller End is not finiſhed, being left pen for the Paſſage of the Wind-pipe, Gullet, nd large Blood-veſſels; and its lower Part, or Baſe, has no Bones, and is ſhorter before than ehind; ſo that, to carry on our Compariſon, t appears like an oblique Section of the Conoid. Beſides which we ought alſo to remark, hat the lower Part of this Cavity is narrower han ſome Way above *(a)*; and that the Middle f its Back-part is conſiderably diminiſhed by he Bones ſtanding forwards into it.

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† Pectus caſſum.

(a) *Albin.* de Oſſib. § 169.

The Bones which form the *Thorax* are the twelve dorſal *Vertebræ* behind, the Ribs on the Sides, and the *Sternum* before.

The *Vertebræ* have already been deſcribed as Part of the Spine; and therefore are now to be paſſed.

The *RIBS*, or *Coſtæ* ‡, (as if they were *Cuſtodes*, or Guards, to theſe principal Organs of the animal Machine, the Heart and Lungs), are the long crooked Bones placed at the Sides of the Cheſt, in an oblique Direction downwards in reſpect of the Back-bone.——Their Number is generally twelve on each Side; tho' frequently eleven or thirteen have been found. ——I never ſaw fewer or more than the ordinary Number, but in the Skeleton of a Boy, about eight Years old, now in my Poſſeſſion; the fourth and fifth Ribs of the left Side are grown together at their Roots for near an Inch, and, afterwards dividing, have the ſame Appearance as the Ribs of the oppoſite Side, which are naturally formed.

The Ribs are all concave internally; where they are alſo made ſmooth by the Action of the contained Parts, which, on this Account, are in no Danger of being hurt by them; and they are convex externally, that they might reſiſt that Part of the Preſſure of the Atmoſphere, which is not ballanced by the Air within the Lungs, during *Inſpiration*.——The Ends of the Ribs next the *Vertebræ* are rounder than they are after theſe Bones have advanced forwards, when they become flatter and broader, and have an

‡ Πλευραὶ, περιςὲρνα, σπάθαι.

an upper and lower Edge, each of which is made rough by the Action of the *intercoſtal* Muſcles, inſerted into them. Theſe Muſcles, being all of nearly equal Force, and equally ſtretched in the Interſtices of the Ribs, prevent the broken Ends of theſe Bones in a Fracture from being removed far out of their natural Place, to interrupt the Motion of the vital Organs.——The upper Edge of the Ribs is more obtuſe and rounder than the lower, which is depreſſed on its internal Side by a long *Foſſa*, for lodging the intercoſtal Veſſels and Nerves; on each Side of which there is a Ridge, to which the intercoſtal Muſcles are fixed. The *Foſſa* is not obſervable however at either End of the Ribs; for at the Poſterior or Root, the Veſſels have not yet reached the Ribs; and, at the Fore-end, they are ſplit away into Branches, to ſerve the Parts between the Ribs: Which plainly teaches Surgeons one Reaſon of the greater Safety of performing the Operation of the *Empyema* towards the Sides of the *Thorax*, than either near the Back or the Breaſt.

At the poſterior End * of each *Rib*, a little Head is formed, which is divided by a middle Ridge into two plain or hollow Surfaces; the loweſt of which is the broadeſt and deepeſt in moſt of them. The two Plains are joined to the Bodies of two different *Vertebræ*, and the Ridge forces itſelf into the interveening Cartilages.——A little Way from this Head, we find on the external Surface a ſmall Cavity, where mucilaginous Glands are lodged; and round the Head, the Bone appears ſpongy, where the capſular Ligament of the Articulation is fixed.——Immediately beyond this a flatted Tubercle riſes, with a ſmall Cavity at, and Roughneſs about its Root, for the Articulation of the Rib with the tranſverſe Proceſs of the loweſt of the two *Vertebræ*, with the Bodies of which the Head of the Rib is joined.—Advancing further on this external Surface, we obſerve in moſt of the Ribs another ſmaller Tubercle, into which Ligaments which connect the Ribs to each other, and to the tranſverſe Proceſſes of the *Vertebræ* and Portions of the *longiſſimus Dorſi*, are inſerted.-----Beyond this the Ribs are made flat by the *Sacro-lumbalis* Muſcle, which is inſerted into the Part of this flat Surface fartheſt from the Spine, where each Rib makes a conſiderable Curve, called by ſome its *Angle.*——Then the Rib begins to turn broad, and continues ſo to its anterior End *, which is hollow and ſpongy, for the Reception of, and firm Coalition with the Cartilage that runs thence to be inſerted into the *Sternum*, or to be joined with ſome other Cartilages.—In Adults generally the Cavity at this End of the Ribs is ſmooth and poliſhed on its Surface; by which the Articulation of the Cartilage with it has the Appearance of being deſigned for Motion; but it has none.

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* Κώπιον, Remulus.

The Subſtance of the Ribs is ſpongy, cellular, and only covered with a very thin external lamellated Surface, which increaſes in Thickneſs and Strength as it approaches the *Vertebræ*.

To the Fore-end of each Rib a long broad and ſtrong Cartilage is fixed, and reaches thence to the *Sternum*, or is joined to the Cartilage of the next Rib. This Courſe, however, is not in a ſtreight Line with the Rib; for generally the Cartilages make a conſiderable Curve, the concave Part of which is upwards; therefore, at their Inſertion into the *Sternum*, they make an obtuſe Angle above, and an acute one below.—Theſe Cartilages are of ſuch a Length, as never to allow the Ribs to come to a right Angle with the Spine; but they keep them ſituated ſo obliquely, as to make an Angle very conſiderably obtuſe above, till a Force exceeding the Elaſticity of the Cartilages is applied.—Theſe Cartilages, as all others, are firmer and harder internally, than they are on their external Surface; and ſome times, in old People, all their middle Subſtance becomes bony, while a thin cartilaginous *Lamella* appears externally (*a*). The Oſſification however begins much oftner at the external Surface.——The greateſt alternate Motions of the Cartilages being made at their great Curvature, that Part remains frequently cartilaginous, after all the reſt is oſſified (*b*).

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* Πλάτη, Palmula.

The Ribs then are articulated at each End, of which the one behind is doubly joined to the *Vertebræ*; for the Head is received into the Cavities of two Bodies of the *Vertebræ*, and the larger Tubercle is received into the Depreſſion in the tranſverſe Proceſs of the lower *Vertebra*.—When one examines this double Articulation, he muſt immediately ſee, that no other Motion can here be allowed, than upwards and downwards; ſince the tranſverſe Proceſs hinders the

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(*a*) *Veſal.* Lib. 1. cap. 19.

(*b*) *Havers.* Oſteolog. nov. Diſc 5. p. 289.

the Rib to be thruſt back; the Reſiſtance on the other Side of the *Sternum*, prevents the Rib's coming forward; and each of the two Joints with the other Parts attached, oppoſe its turning round. But then it is likewiſe as evident, that even the Motion upwards and downwards, can be but ſmall in any one Rib at the Articulation itſelf. But as the Ribs advance forwards, the Diſtance from their Center of Motion increaſing, the Motion muſt be larger; and it would be very conſpicuous at their anterior Ends, were not they reſiſted there by the Cartilages, which yield ſo little, that the principal Motion is performed by the middle Part of the Ribs, which turns outwards and upwards, and occaſions the Twiſt remarkable in the long Ribs at the Place near their Fore-end where they are moſt reſiſted (*a*).

Hitherto I have laid down the Structure and Connexion which moſt of the Ribs enjoy, as belonging to all of them; but muſt now conſider the Specialities wherein any of them differ from the general Deſcription given, or from each other.

In viewing the Ribs from above downwards, their Figure is ſtill ſtreighter; the uppermoſt being the moſt crooked of any.—Their Obliquity in reſpect of the Spine increaſes as they deſcend; ſo that though their Diſtance from each other is very little different at their Back-part, yet at their Fore-ends the Diſtances between the lower ones muſt increaſe.—In Conſequence too of this increaſed Obliquity of the lower Ribs, each

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(*a*) Winſlow Mem. de l'Acad. des Sciences, 1720.

each of their Cartilages makes a greater Curve in its Progreſs from the Rib towards the *Sternum*; and the Tubercles, that are articulated to the tranſverſe Proceſſes of the *Vertebræ*, have their ſmooth Surfaces gradually facing more upwards.——The Ribs becoming thus more oblique, while the *Sternum* advances forwards in its Deſcent, makes the Diſtance between the *Sternum* and the anterior End of the lower Ribs greater than between the *Sternum* and the Ribs above; conſequently the Cartilages of thoſe Ribs that are joined to the Breaſt-bone are longer in the lower than in the higher ones.--Theſe Cartilages are placed nearer to each other as the Ribs deſcend, which occaſions the Curvature of the Cartilages to be greater.

The Length of the Ribs increaſes from the firſt or uppermoſt Rib, as far down as the ſeventh; and from that to the twelfth, as gradually diminiſhes.——The ſuperior of the two plain, or rather hollow Surfaces, by which the Ribs are articulated to the Bodies of the *Vertebrae*, gradually increaſes from the firſt to the fourth Rib, and is diminiſhed after that in each lower Rib.——The Diſtance of their Angles from the Heads always increaſes as they deſcend to the ninth, becauſe of the greater Breadth of the *Sacrolumbalis* Muſcle (*a*).

The Ribs are commonly divided into *true* and *falſe*.

The *true* * *Coſtæ* are the ſeven upper ones of each Side, whoſe Cartilages are all gra-

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(*a*) *Winſlow*, Expoſition Anatomique des Os Secs, §. 643.
* Γνήσαι, Germanæ, legitimæ.

dually longer as the Ribs deſcend, and are joined to the Breaſt-bone; ſo that being preſſed conſtantly between two Bones, they are flatted at both Ends, and are thicker, harder, and more liable to oſſify, than the other Cartilages, that are not ſubject to ſo much Preſſure. Theſe Ribs include the Heart and Lungs; and therefore are the proper or true *Cuſtodes* of Life.

The five inferior Ribs of each Side are the *falſe* or *BASTARD* †, whoſe Cartilages do not reach to the *Sternum*; and therefore, wanting the Reſiſtance at their Fore-part, they are there pointed; and, on this Account, having leſs Preſſure, their Subſtance is ſofter. ——The Cartilages of theſe *falſe Ribs* are ſhorter as the Ribs deſcend.——To all theſe five Ribs the circular Edge of the *Diaphragm* is connected; and its Fibres, inſtead of being ſtretched immmediately tranſverſely, and ſo running perpendicular to the Ribs, are preſſed ſo as to be often, eſpecially in Exſpiration, parallel to the Plane in which the Ribs lie: Nay, one may judge by the Attachments which theſe Fibres have ſo frequently to the Sides of the *Thorax*, a conſiderable Way above where their Extremities are inſerted into the Ribs, and by the Situation of the *Viſcera*, always to be obſerved in a dead Subject laid ſupine, that there is conſtantly a large Concavity formed on each Side by the *Diaphragm* within theſe baſtard Ribs, in which the Stomach, Liver, Spleen, *&c.* are contained; which, being only reckoned among the *Viſcera naturalia* have occaſioned the Name of *Baſtard Cuſtodes* to theſe Bones.

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† Μαλθάκαι, χονδρώδεις, ἀκανθαι, κτένες, ρόαι, adulterinæ ſpuriæ, illegitimæ.

Hence in ſimple Fractures of the falſe Ribs, without Fever, the Stomach ought to be kept moderately filled with Food, leſt the pendulous Ribs falling inwards, ſhould thereby increaſe the Pain, Cough, *&c.* (*a*).——Hence likewiſe we may learn how to judge better of the Seat of ſeveral Diſeaſes, and to do the Operation of the *Empyema*, and ſome others, with more Safety than we can do, if we follow the common Directions.

The eight upper Ribs were formerly (*b*) claſſed into Pairs, with particular Names to each two, to wit, the *crooked*, the *ſolid*, the *pectoral*, the *twiſted*: But theſe Names are of ſo little Uſe, that they are now generally neglected.

The *firſt* Rib of each Side is ſo ſituated, that the flat Sides are above and below, while one Edge is placed inwards, and the other outwards, or nearly ſo; therefore ſufficient Space is left above it for the Subclavian Veſſels and Muſcle; and the broad concave Surface is oppoſed to the Lungs: But then, in Conſequence of this Situation, the Channel for the intercoſtal Veſſels is not to be found, and the Edges are differently formed from all the other, except the ſecond; the lower one being rounded, and the other ſharp.——The Head of this Rib is not divided into two plain Surfaces by

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(*a*) *Hippocrat* de Articulo. § 51.---*Parè*, Lib. 15. cap. 11.

(*b*) *Laurent.* Hiſt. Anat. lib. 2. cap. 29.------*Paaw.* de Oſſibus. Part. 3. cap. 2.

a middle Ridge, becauſe it is only articulated with the firſt *Vertebra* of the *Thorax*.——Its Cartilage is oſſified in Adults, and is united to the *Sternum* at right Angles.——Frequently this firſt Rib has a Ridge riſing near the Middle of its poſterior Edge, where one of the Heads of the *Scalenus* Muſcle riſes.——Farther forward it is flatted, or ſometimes depreſſed by the Clavicle.

The fifth, ſixth, and ſeventh, or rather the ſixth, ſeventh, eighth, and ſometimes the fifth, ſixth, ſeventh, eighth, ninth Ribs, have their Cartilages at leaſt contiguous; and frequently they are joined to each other by croſs Cartilages; and moſt commonly the Cartilages of the eighth, ninth, tenth, are connected to the former, and to each other by firm Ligaments.

The *eleventh*, and ſometimes the *tenth* Rib, has no Tubercle for its Articulation with the tranſverſe Proceſs of the *Vertebra*, to which it is only looſely fixed by Ligaments.——The *Foſſa* in its lower Edge, is not ſo deep as in the upper Ribs, becauſe the Veſſels run more towards the Interſtice between the Ribs.——Its Fore-end is ſmaller than its Body, and its ſhort ſmall Cartilage is but looſely connected to the Cartilage of the Rib above.

The *twelfth* Rib is the ſhorteſt and ſtraighteſt.——Its Head is only articulated with the laſt *Vertebra* of the *Thorax*; therefore is not divided into two Surfaces.——This Rib is not joined to the tranſverſe Proceſs of the *Vertebra*, and therefore has no Tubercle, being often pulled neceſſarily inwards by the Diaphragm, which an Articulation with the tranſverſe Proceſs would not have allowed.——The *Foſſa* is not found at its under Edge, becauſe the Veſſels run below it.——The Fore-part of this Rib is ſmaller than its Middle, and has only a very ſmall-pointed Cartilage fixed to it.——To its whole internal Side the Diaphragm is connected.

The Motion and Uſes of the Ribs ſhall be more particularly treated of, after the Deſcription of the *Sternum.*

The Heads and Tubercles of the Ribs of a new-born Child have Cartilages on them; Part of which, becomes afterwards thin Epiphyſes. ——The Bodies of the Ribs incroach gradually after Birth upon the Cartilages; ſo that the latter are proportionally ſhorter, when compared to the Ribs, in Adults, than in Children.

Here I cannot help remarking the wiſe Providence of our Creator, in preſerving us from periſhing as ſoon as we come into the World. The End of the Bones of the Limbs remain in a cartilaginous State after Birth, and are many Years before they are entirely united to the main Body of their ſeveral Bones; whereas the Condyles of the occipital Bone, and of the lower Jaw, are true original Proceſſes, and oſſified before Birth, and the Heads and Tubercles of the Ribs are nearly in the ſame Condition; and therefore the Weight of the large Head is firmly ſupported; the Actions of Sucking, Swallowing, Reſpiration, *&c.* which are indiſpenſably neceſſary for us as ſoon as we come into the World, are performed without Danger of ſeparating the Parts of the Bones that are moſt preſſed on in theſe Motions: Whereas, had theſe Proceſſes of the Head, Jaw, and Ribs, been Epiphyſes at Birth, Children muſt have been expoſed to Danger of dying by ſuch a Separation; the immediate Conſequences of which would be the Compreſſion of the Beginning of the *ſpinal* Marrow, or want of Food, or a Stop put to Reſpiration.

The *STERNUM* *, or *Breaſt-bone*, is the broad flat Bone, or Pile of Bones, at the Fore-part of the *Thorax*. —— The Number of Bones, which this ſhould be divided into, has occaſioned Debates among Anatomiſts, who have conſidered it in Subjects of different Ages.——In Adults of a middle Age, it is compoſed of three Bones, which eaſily ſeparate after the Cartilages connecting them are deſtroyed. Frequently the two lower Bones are found intimately united; and very often in old People, the *Sternum* is a continued bony Subſtance from one End to the other; though we ſtill obſerve two, ſometimes three, tranſverſe Lines on its Surface; which are Marks of the former Diviſions.

When we conſider the *Sternum* as one Bone, we find it broadeſt and thickeſt above, and becoming ſmaller as it deſcends. The internal Surface of this Bone is ſomewhat hollowed for enlarging the *Thorax*; but the Convexity on the external Surface is not ſo conſpicuous, becauſe the Sides are preſſed outwards by

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* Στῆθος, Os Pectoris, enſiforme, ſcutum cordis.

y the true Ribs; the round Heads of whoſe
Cartilages are received into ſeven ſmooth Pits,
ormed in each ſide of the *Sternum*, and are
ept firm there by ſtrong Ligaments, which on
he external Surface have a particular radiated
Texture (*a*).-- Frequently the cartilaginous Fibres
hruſt themſelves into the bony Subſtance of
he *Sternum*, and are joined by a Sort of Su-
ure.——The Pits at the upper Part of the
Sternum, are at the greateſt Diſtance one from
nother, and, as they deſcend, are nearer; ſo
hat the two loweſt are contiguous.

The Subſtance of the Breaſt-bone is cellu-
ar, with a very thin external Plate, eſpe-
cially on its internal Surface, where we may
requently obſerve a cartilaginous Cruſt ſpread
ver it (*b*). On both Surfaces, however, a
trong ligamentous Membrane is cloſely bra-
ced; and the Cells of this Bone are ſo ſmall,
hat a conſiderable Quantity of oſſeous Fibres
nuſt be employed in the Compoſition of it:
Whence, with the Defence which the Muſcles
give it, and the moveable Support it has from
he Cartilages, it is ſufficiently ſecured from
eing broken; for it is ſtrong by its Quantity
f Bone; its Parts are kept together by Liga-
nents; and it yields enough to elude conſide-
ably the Violence offered (*c*).

So far may be ſaid of this Bone in general;
ut the three Bones, of which, according to
the

(*a*) *Ruyſch*, Catalog. Rar. fig. 9.
(*b*) *Jac. Sylv.* in Galen. de Oſſibus, cap. 12.
(*c*) *Senac.* in Memoires de l'Acad. des Sciences, 1724.

the common Account, it is compoſed in Adults are each to be examined.

The *firſt*, all agree, is ſomewhat of the Figure of a Heart, as it is commonly painted only it does not terminate in a ſharp Point ——This is the uppermoſt thickeſt Part of th *Sternum.*

The upper Middle-part of this firſt Bone where it is thickeſt, is hollowed, to mak Place for the *Trachea arteria;* though thi Cavity * is principally formed by the Bon being raiſed on each Side of it, partly by th Clavicles thruſting it inwards, and partly b the *Sterno-maſtoidei* Muſcles pulling it upwards.———On the Outſide of each Tubercle there is an oblong Cavity, that, in viewing it tranſverſely from before backwards, appear a little convex: Into theſe *Glenæ* the Ends o the Clavicles are received.—— Immediately below theſe, the Sides of this Bone begin t turn thinner; and in each a ſuperficial Cavity or a rough Surface is to be ſeen, where the firſt Ribs are received or joined to the *Sternum.*———In the Side of the under End of this firſt Bone, the half of the Pit for the ſecond Rib on each Side is formed.——The upper Part of the Surface behind is covered with a ſtrong Ligament, which ſecures the Clavicles; and is afterwards to be more particularly taken notice of.

The ſecond or middle Diviſion of this Bone, is much longer, narrower, and thinner, than the firſt; but, excepting that it is a little nar-

rower

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[*] Σφαγή, Jugulum, Furcula ſuperior.

rower above than below, it is nearly equal all over in its Dimenſions of Breadth or Thickneſs.——In the Sides of it are compleat Pits for the third, fourth, fifth, and ſixth Ribs, and an half of the Pits for the ſecond and ſeventh. The Lines, which are Marks of the former Diviſion of this Bone, being extended from the Middle of the Pits of one Side to the Middle of the correſponding Pits of the other Side.——Near its Middle an unoſſified Part of the Bone is ſometimes found, which, freed of the ligamentous Membrane or Cartilage that fills it, is deſcribed as a Hole; and in this Place, for the moſt Part, we may obſerve a tranſverſe Line, which has made Authors divide this Bone into two.——When the Cartilage between this and the firſt Bone is not oſſified, a manifeſt Motion of this upon the firſt may be obſerved in Reſpiration, or in raiſing the *Sternum*, by pulling the Ribs upwards in a recent Subject.

The third Bone is much leſs than the other two, and has only one half of the Pit for the ſeventh Rib formed in it; wherefore it might be reckoned only an *Appendix* of the *Sternum*.——In young Subjects it is always cartilaginous, and is better known by the Name of *Cartilago xiphoides* or *enſiformis* †, than any other; though the Antients often called the whole *Sternum*, *Enſiforme*, comparing

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† Clypealis, gladialis, mucronata, malum, granatum, ſcutum ſtomachi, epiglottalis, cultralis, Medium Furculæ inferioris, ſcutiformis, enſiculata.

ring the two firſt Bones to the Handle, and this *Appendix* to the Blade of a Sword.——This third Bone is ſeldom of the ſame Figure, Magnitude, or Situation in any two Subjects; for ſometimes it is a plain triangular Bone, with one of the Angles below, and perpendicular to the Middle of the upper Side, by which it is connected to the ſecond Bone.——In other People the Point is turned to one Side; or obliquely forwards or backwards.——Frequently it is all nearly of an equal Breadth, and in ſeveral Subjects it is bifurcated; whence ſome Writers give it the Name of *Furcella* or *Furcula inferior*; or elſe it is unoſſified in the Middle.——In the greateſt Number of Adults it is oſſified, and tipped with a Cartilage; in ſome one half of it is cartilaginous, and in others it is all in a cartilaginous State.——Generally ſeveral oblique Ligaments fixed at one End to the Cartilages of the Ribs, and by the other to the outer Surface of the *xiphoid* Bone, connect it firmly to thoſe Cartilages (*a*).

So many different Ways this ſmall Bone may be formed, without any Inconvenience But then ſome of theſe Poſitions may be ſ directed, as to bring on a great Train of il Conſequences; particularly, when the lower End is oſſified, and is too much turned outwards or inwards (*b*), or when the Conjunction

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(*a*) *Weitbrecht*, Syndeſmolog. p. 121.

(*b*) *Rolfinc.* Diſſert. Anat. lib. 2. cap. 41.——*Paaw*, de Oſſib. part. 1. cap. 3. & part 3. cap. 3.

tion of this *Appendix* with the ſecond Bone is too weak (*c*).

The *Sternum* is joined by Cartilages to the ſeven upper Ribs, unleſs when the firſt coaleſces with it in an intimate Union of Subſtance; and its unequal Cavity on each Side of its upper End is fitted for the Ends of the Clavicles.

The *Sternum* moſt frequently has four round ſmall Bones, ſurrounded with Cartilage, in Children born at the full Time; the uppermoſt of theſe, which is the firſt Bone, being the largeſt.——Two or three other very ſmall bony Points are likewiſe to be ſeen in ſeveral Children.——The Number of Bones increaſes for ſome Years, and then diminiſhes but uncertainly, till they are at laſt united into thoſe above deſcribed of an Adult.

The Uſes of this Bone are, to afford Origin and Inſertion to ſeveral Muſcles; to ſuſtain the *Mediaſtinum*, to defend the vital Organs, the Heart and Lungs, at the Fore-part; and, laſtly, by ſerving as a moveable *Fulcrum* of the Ribs, to aſſiſt conſiderably in Reſpiration: Which Action, ſo far as it depends on the Motion of the Bones, we are now at Liberty to explain.

When the Ribs that are connected by their Cartilages to the *Sternum*, or to the Cartilages of the true Ribs, are acted upon by the intercoſtal Muſcles, they muſt all be pulled from the oblique

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(*c*) *Paaw.* Ibid.—*Borrich.* Act. *Hafn.* vol. 5. Obſ. 79.—*Bonet.* Sepulchret. Anat. tom. 2. lib. 3. § 5. Append. ad Obſ. 8. & ibid. § 7. Obſ. 19.

oblique Poſition which their Cartilages kept them in, nearer to right Angles with the *Vertebræ* and *Sternum*, becauſe the firſt or uppermoſt Rib is by much the moſt fixed of any and the Cartilages making a great Reſiſtance to raiſing the anterior Ends of the Ribs, their large arched middle Parts turn outwards as well as upwards.——The *Sternum*, preſſed ſtrongly on both Sides by the Cartilages of the Ribs, is puſhed forwards, and that at its ſeveral Parts in Proportion to the Length and Motion of its Supporters, the Ribs; that is, moſt at its lower End.——The *Sternum* and the Cartilages, thu raiſed forwards, muſt draw the *Diaphragm* connected to them; conſequently ſo far ſtretch it and bring it nearer to a Plane.——The Power that raiſes this Bone and the Cartilages, fixe them ſufficiently to make them reſiſt the Action of the *Diaphragm*, whoſe Fibres contract at the ſame Time, and thruſt the *Viſcera* of the *Abdomen* downwards.——The arched Part of the Ribs being thus moved outwards, their anterio Ends and the *Sternum* being advanced forwards and the Diaphragm being brought nearer to plain Surface, inſtead of being greatly conve on each Side within each Cavity of the *Thorax* it is evident how conſiderably the Cavity, o which the nine or ten upper Ribs are the Sides muſt be widened, and made deeper and longer.——While this is doing in the upper Ribs the lower ones, whoſe Cartilages are not joine to the *Sternum* or to other Cartilages, mov very differently, though they conſpire to the ſame Intention, the Enlargement of the *Thorax:* For having no fixed Point to which thei anterio anterior Ends are faſtened, and the *Diaphragm* being inſerted into them at the Place where it runs pretty ſtreight upwards from its Origin at the *Vertebræ*, theſe Ribs are drawn downwards by this ſtrong Muſcle, and by the Muſcles of the *Abdomen*, which, at this Time, are reſiſting the ſtretching Force of the Bowels; while the intercoſtal Muſcles are pulling them in the contrary Direction, to wit, upwards: The Effect therefore of either of theſe Powers, which are Antagoniſts to each other, is very little, as to moving the Ribs either up or down; but the Muſcles of the *Abdomen*, puſhed at this Time outwards by the *Viſcera*, carry theſe Ribs along with them.——Thus the *Thorax* is not only not llowed to be ſhortened, but is really widened t its lower Part, to aſſiſt in making ſufficient Space for the due Diſtenſion of the Lungs.

As ſoon as the Action of theſe ſeveral Muſcles ceaſes, the elaſtic Cartilages extending hemſelves to their natural Situation, depreſs he upper Ribs, and the *Sternum* ſubſides;——he Diaphragm is thruſt up by the *Viſcera abdominalia*, and the oblique and tranſverſe Muſcles of the Belly ſerve to draw theſe Ribs inwards t the ſame time.——By theſe Cauſes, the Cavity of the Breaſt is diminiſhed in all its Dimenſions.

Though the Motions above deſcribed of the Ribs and *Sternum*, eſpecially of the latter Bone, re ſo ſmall in the mild Reſpiration of a healhy Perſon, that we can ſcarce obſerve them; et they are manifeſt whenever we deſignedly icreaſe our Reſpiration, or are obliged to do after Exerciſe, and in ſeveral Diſeaſes.

Of the SUPERIOR EXTREMITIES.

AUthors are much divided in their Opinions about the Number of Bones which each *ſuperior Extremity* † ſhould be ſaid to conſiſt of, ſome deſcribing the *Clavicle* and *Scapula* as Part of it, others claſſing theſe two Bones with thoſe of the *Thorax*: But ſince moſt Quadrupeds have no *Clavicles*, and the human *Thorax* can per- form its Functions right when the *Scapula* is taken away (*a*), whereas it is impoſſible for us to have the right Uſe of our Arms without theſe Bones; I muſt think that they belong to the *ſuperior Extremities*; and therefore ſhall divide each of them into the *Shoulder*, *Arm*, *Fore-arm*, and *Hand*.

The *SHOULDER* conſiſts of the *Clavicl* and *Scapula*.

CLAVICULA, or *Collar-bone* *, is the long crooked Bone, in Figure like an *Italick ſ* place almoſt horizontally between the upper latera Part of the *Sternum*, and what is commonl called the Top of the Shoulder, which, as *Clavis* or Beam, it bears off from the Trunk c the Body.

The *Clavicle*, as well as other long roun Bones, is larger at its two Ends, than in th Middle. The End next to the *Sternum* † [illegible] triangular: The Angle behind is conſiderably produced, to form a ſharp Ridge, to which the tranſverſe Ligament extended from one Clavicle to the other is fixed (*a*).—The Side oppoſite to this is ſomewhat rounded.—The Middle of this protuberant End, is as irregularly hollowed, as the Cavity in the *Sternum* for receiving it is raiſed; but, in a recent Subject, the irregular Concavities of both, are ſupplied by a moveable Cartilage, which is much more cloſely connected every where by Ligaments to the Circumference of the Articulation, than thoſe of the Lower Jaw are; but grows to the two Bones at both its internal and external End; its Subſtance at the internal End being ſoft, but very ſtrong, and reſembling the intervertebral Cartilages (*b*).

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† Κῶλα, γυῖα, ἐκφύαδες, Enata, adnata, explantata membr artus.

(*a*) Philoſoph. Tranſact. Num. 449. § 5.

* Os jugulare, jugulum, furcula, ligula, clavis, humer quibuſdam.

† Παρασφάγις.

From this internal End, the *Clavicle*, for about two Fifths of its Length, is bended obliquely forwards and downwards. On the Upper and Fore-part of this Curvature a ſmall Ridge is ſeen, with a plain rough Surface before it; whence the *Muſculus ſterno-hyoideus* and *ſterno-maſtoideus* have in Part their Origin.——Near the lower Angle a ſmall plain Surface is often to be remarked, where the firſt Rib and this Bone are contiguous (*c*), and are connected by a firm Ligament (*d*).—-From this a rough plain Surface is extended outwards, where the pectoral Muſcle has Part of its Origin.——Behind, the

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(*a*) *Riolan.* Encherid. Anat. lib. vi. cap. 13.——*Winſlow*, Expoſ. Anat. des Os frais, § 248.—*Weitbrecht.* Act. Petropolit. tom. 4. p. 255. & Syndeſmolog. Sect. 2. I. 3.

(*b*) *Weitbrecht*, Syndeſmolog. Sect. 2. I. § 6.

(*c*) *Dionis*, Sixieme Demonſt. des Os.

(*d*) *Weitbrecht*, Syndeſmolog. Sect. 2. I. § 7.

the Bone is made flat and rough by the Inſertion of the larger Share of the Subclavian Muſcle.——After the Clavicle begins to be bended backwards, it is round, but ſoon after becomes broad and thin; which Shape it retains to its external End.——Along the external Concavity, a rough Sinuoſity runs, from which ſome Part of the Deltoid Muſcle takes its Riſe: ——Oppoſite to this, on the convex Edge, a ſcabrous Ridge gives Inſertion to a Share of the *cucullaris* Muſcle. The upper Surface of the Clavicle here is flat; but the lower is hollow, for lodging the Beginning of the *Muſculus ſubclavius*, and towards its Back-part a Tubercle riſes, to which, and a Roughneſs near it, the ſtrong ſhort thick Ligament connecting the Bone to the *coracoid* Proceſs of the *Scapula* is fixed.

The external End * of this Bone is horizontally oblong, ſmooth, ſloping at the poſterior Side, and tipped in a recent Subject with a Cartilage, for its Articulation with the *Acromion ſcapulæ*.——Round this the Bone is ſpongy, for the firmer Connexion of the Ligaments.

The medullary Arteries, having their Direction obliquely outwards, enter the Clavicles by one or more ſmall Paſſages in the Middle of their Back-part.

The Subſtance of this Bone is the ſame as of the other round long Bones.

The triangular unequal interior End of each *Clavicle*, has the Cartilage above deſcribed, interpoſed betwixt it and the irrelar Cavity of the *Sternum*.——The Ligaments, which ſurround this Articulation to ſecure it, are ſo ſhort and ſtrong, that little Motion can be allowed any way: and the ſtrong Ligament that is ſtretched acroſs the upper *Furcula* of the *Sternum*, from the poſterior prominent Angle of the one Clavicle, to the ſame Place of the other Clavicle, ſerves to keep each of theſe Bones more firmly in their Place. ——By the Aſſiſtance, however, of the moveable interveening Cartilage, the Clavicle can, at this Joint, be raiſed or depreſſed, and moved backwards and forwards ſo much, as that the external End, which is at a great Diſtance from that Axis, enjoys very conſpicuous Motions.—The Articulation of the exterior End of the Clavicle ſhall be conſidered after the Deſcription of the *Scapula*.

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* Ἐπωμὶς.

The Clavicles of Infants are not deficient in any of their Parts; nor have they any Epiphyſes at their Extremities joined afterwards to their Bodies, as moſt other ſuch long Bones have, which preſerves them from being bended too much, and from the Danger of any unoſſified Parts being ſeparated by the Force which pulls the Arms forwards.

The Uſes of the Clavicles are, to keep the *Scapulæ*, and conſequently all the *ſuperior Extremities*, from falling in and forward upon the *Thorax*; by which, as in moſt Quadrupeds, the Motions of the Arms would be much confined, and the Breaſt made too narrow.——The Clavicles likewiſe afford Origin to ſeveral Muſcles, and a Defence to large Veſſels.

From the Situation, Figure and Uſe of the Clavicles, it is evident, that they are much ex-

poſed to Fractures; that their broken Parts muſ
generally go bye each other, and that they ar
difficultly kept in their Place afterwards.

SCAPULA, or *Shoulder-blade* *, is the tri
angular Bone ſituated on the Outſide of th
Ribs, with its longeſt Side, called its *Baſe*
towards the ſpinal Proceſſes of the *Vertebræ*
and with the Angle at the upper Part o
this Side about three Inches, and the lowe
Angle at a greater Diſtance from theſe Proceſ
ſes.—The Back-part of the *Scapula* has nothin
but the thin Ends of the *Serratus anticus majo*
and *Subſcapularis* Muſcles between it and th
Ribs: But as this Bone advances forwards, it
Diſtance from the Ribs increaſes.——The uppe
or ſhorteſt Side, called the *ſuperior Coſta* of th
Scapula, is nearly horizontal, and parallel with
the ſecond Rib.——The lower Side, which i
named the *inferior Coſta*, is extended obliquel
from the third to the eighth Rib.——The infe
rior Angle is very acute; the upper one is nea
to a right Angle; and what is called the ante
rior, does not deſerve the Name; for the tw
Sides do not meet to form an Angle.—The Bo
dy of this Bone is concave towards the Ribs
and convex behind, where it has the Name o
Dorſum †.——Three Proceſſes are generall
reckoned to proceed from the *Scapula*.——Th
firſt is the large Spine that riſes from its conve
Surface behind, and divides it unequally.——
The ſecond Proceſs ſtands out from the Fore
part of the upper Side; and, from its imaginar
Re

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* Ὠμοπλάτος, ἐπινώτιον, Latitudo humeri, ſcoptulum v
ſcutulum opertum, ſpatula, ala, humerus, clypeus, ſcutu
thoracis.

† Χελώνιον.

Reſemblance to a Crow's Beak, is named *Coracoides* ‡.—-The third Proceſs is the whole thick bulbous Fore-part of the Bone.

After thus naming the ſeveral conſtituent Parts of the *Scapula*, the particular Deſcription will be more eaſily underſtood.

The *Baſe*, which is tipped with Cartilage in a young Subject, is not all ſtreight: For above the Spine, it runs obliquely forwards to the ſuperior Angle; that here it might not be too protuberant backwards, and ſo bruiſe the Muſcles and Teguments: Into the oblique Space the *Muſculus patientiæ* is inſerted.——At the Root of the Spine, on the Back-part of the Baſe, a triangular plain Surface is formed, by the Preſſure of the lower Fibres of the *Trapezius*.——Below this the Edge of the *Scapula* is ſcabrous and rough, for the Inſertion of the *Serratus major anticus* and *rhomboid* Muſcles.

The Back-part of the inferior Angle is made ſmooth by the *latiſſimus Dorſi* paſſing over it. This Muſcle alſo alters the Direction of the *inferior Coſta* ſome way forwards from this Angle; and ſo far it is flatted behind by the Origin of the *Teres major*.—As the *inferior Coſta* advances forward, it is of conſiderable Thickneſs, is ſlightly hollowed, and made ſmooth behind by the *Teres minor*, while it has a *Foſſa* formed into it below by Part of the *Subſcapularis*; and between the two a Ridge with a ſmall Depreſſion appears, where the *longus extenſor Cubiti* has its Origin.

The *ſuperior Coſta* is very thin; and near its Fore-part there is a ſemilunar Nitch, from one End of which to the other a Ligament is ſtretched; and ſometimes the Bone is continued, to form one, or ſometimes two Holes for the Paſſage of the ſcapular Blood-veſſels and Nerves.——Immediately behind this *ſemilunar* Cavity the *coraco-hyoid* Muſcle has its Riſe.—From the Nitch to the Termination of the *Foſſa* for the *Teres minor*, the *Scapula* is narrower than any where elſe, and ſupports the third Proceſs. This Part has the Name of *Cervix*.

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‡ Anchoroides, ſigmoides, digitalis, anciſtroides.

The whole *Dorſum* of the *Scapula* is always ſaid to be convex; but, by Reaſon of the raiſed Edges that ſurround it, it is divided into two Cavities by the Spine, which is ſtretched from behind forwards, much nearer to the ſuperior, than to the inferior *Coſta*—The Cavity above the Spine is really concave where the *ſupra-ſpinatus* Muſcle is lodged; while the Surface of this Bone below the Spine, on which the *infra-ſpinatus* Muſcle is placed, is convex, except a *Foſſa* that runs at the Side of the *inferior Coſta*.

The internal or anterior Surface of this Bone is hollow, except in the Part above the Spine, which is convex.——The *ſubſcapularis* Muſcle is extended over this Surface, where it forms ſeveral Ridges and intermediate Depreſſions, commonly miſtaken for Prints of the Ribs; they point out the Interſtices of the Bundles of Fibres of which the *ſubſcapularis* Muſcle is compoſed (*a*).

The Spine * riſes ſmall at the Baſe of the *Scapula*, and becomes higher and broader as it advances forwards.——On the Sides it is unequally

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(*a*) *Winſlow*, in Memoires de l'Acad. des Sciences, 1722.

* Ῥαχις, ὑπερόχη ὠμοπλατῶν, Eminentia ſcapularum.

unequally hollowed and crooked, by the Actions of the adjacent Muſcles.——Its Ridge * is divided into two rough flat Surfaces: Into the upper one, the *Trapezius* Muſcle is inſerted; and the lower one has Part of the *Deltoid* fixed to it.——The End of the Spine, called *Acromion* †, or Top of the Shoulder, is broad and flat, and is ſometimes only joined to the Spine by a Cartilage.——The anterior Edge of the *Acromion* is flat, ſmooth, and covered with a Cartilage, for its Articulation with the external End of the Clavicle; and it is hollowed below, to allow a Paſſage to the *infra* and *ſupra-ſpinati* Muſcles, and free Motion to the *Os humeri.*

The *coracoid* § Proceſs is crooked, with its Point inclining forwards; ſo that a Hollow is left at the lower Side of its Root, for the Paſſage of the *infra-ſcapularis* Muſcle.——The End of this Proceſs is marked with three plain Surfaces. Into the internal, the *Serratus minor anticus* is inſerted: From the external, one Head of the *Biceps flexor cubiti* riſes; and from the lower one, the *Coracobrachialis* has its Origin.——At the Upper-part of the Root of this Proceſs, immediately before the *ſemilunar* Cavity, a ſmooth Tubercle appears, where a Ligament from the *Clavicle* is fixed. From all the external Side of this coracoid *Apophyſe*, a broad Ligament goes out, which becomes narrower where it is fixed to the

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* Pterygium, criſta.

† 'Επωμις, ἀγκυροειδὴς, κορακοειδὴς, κατακλεῖς, Acromii os, ſummus armus, roſtrum porcinum, proceſſus digitalis.

§ 'Αγκυροειδὴς, σιγμοειδὴς, Roſtriformis.

Acromion.——The ſharp Pain, violent Inflammation, and tedious Cure of Contuſions in thi Part, are probably owing to theſe Tendon and Ligaments being hurt.

From the *Cervix ſcapulæ* the third Proceſ is produced. The Fore-part of this is formed into a *Glenoid* Cavity †, which is of th Shape of the longitudinal Section of an Egg being broad below, and narrow above.—— Between the Brims of this Hollow and th Fore-part of the Root of the Spine, a larg Sinuoſity is left, for the Tranſmiſſion of th *ſupra* and *infra-ſpinati* Muſcles; and on th Upper-part of theſe Brims we may remark ſmooth Surface, where the ſecond Head of th *Biceps flexor cubiti* has its Origin.——Th Root of the *Supercilia* is rough all round, fo the firmer Adheſion of the capſular Ligamen of the Articulation, and of the Cartilage which is placed on theſe Brims, where it is thick but becomes very thin as it is continued towards the Middle of the Cavity, which it line all over.

The medullary Veſſels enter the *Scapula* near the Baſe of the Spine.——

The Subſtance of the *Scapula*, as in al other broad flat Bones, is cellular, but of an unequal Thickneſs; for the Neck and third Proceſs are thick and ſtrong. The inferior *Coſta* Spine, and coracoid Proceſs, are of a middl Thickneſs; and the Body is ſo preſſed by th Muſcles, as to become thin and diaphanous.

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† Ωμοκότυλις.

The *Scapula* and Clavicle are joined by plain Surfaces, tipped with Cartilage *; by which neither Bone is allowed any conſiderable Motion, being tightly tied down by the common capſular Ligament, and by a very ſtrong one which proceeds from the coracoid Proceſs; but divides into two before it is fixed into the *Clavicle*, with ſuch a Direction, as either can allow this Bone to have a ſmall Rotation, in which its poſterior Edge turns more backwards, while the anterior one riſes farther forwards; or it can yield to the Forepart of the *Scapula* moving downwards, while the Back-part of it is drawn upwards; in both which Caſes the oblong ſmooth articulated Surfaces of the *Clavicle* and *Scapula* are not in the ſame Plane, but ſtand a little tranverſely, or acroſs each other, and thereby preſerve this Joint from Luxations, to which it would be ſubject, if either of the Bones was to move on the other perpendicularly up and down, without any Rotation.——Sometimes a moveable ligamentous Cartilage is found in this Joint; otherwhiles ſuch a Cartilage is only interpoſed at the anterior Half of it; and in ſome old Subjects I have found a ſeſamoid Bone here (*a*)——The *Scapula* is connected to the Head, *Os hyoides*, *Vertebræ*, Ribs, and Arm-bone, by Muſcles, that have one End faſtened to theſe Bones, and the other to the *Scapula*, which can move it upwards, downwards, backwards or forwards; by the quick Succeſſion of theſe Motions, its whole Body is carried in a Circle. But being alſo often moved, as upon an Axis perpendicular to its Plane, its Circumference turns in a Circle whoſe Center this Axis is (*a*). Whichever of theſe Motions it performs, it always carries the outer End of the Clavicle and the Arm along with it.—— The *glenoid* Cavity of this Bone receives the *Os humeri*, which plays in it as a Ball in a Socket, as will be explained more hereafter.

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* Acromion, κατακλεις, Clauſuræ.

(*a*) *Jac. Sylv.* Iſagog. Anat. lib. 1. cap. 2.

The Uſe of the *Scapula* is, to ſerve as a *Fulcrum* to the Arm; and, by altering its Poſition on different Occaſions, to allow always the Head of the *Os humeri* a right ſituated Socket to move in; and thereby to aſſiſt and to enlarge greatly the Motions of the *ſuperior Extremity*, and to afford the Muſcles which riſe from it more advantageous Actions, by altering their Directions to the Bone which they are to move.——This Bone alſo ſerves to defend the Back-part of the *Thorax*, and is often employed to ſuſtain Weights, or to reſiſt Forces, too great for the Arm to bear.

The Baſe, *Acromion*, coracoid Proceſs, and Head of the *Scapula*, are all in a cartilaginous State at Birth; and the three firſt are joined as *Epiphyſes*; while the Head, with the *glenoid* Cavity, is not formed into a diſtinct ſeparate Bone, but is gradually produced by the oſſification of the Body of this Bone being continued forwards.

The *ARM* has only one Bone, beſt known by the

(*a*) See *Winſlow*. Memoires de l'Acad. des Sciences, 1726.

the *Latin* Name of *Os humeri* [†]; which is long, round, and nearly ſtreight.

The upper End of this Bone [*] is formed into a large round ſmooth Head, whoſe middle Point is not in a ſtreight Line with the Axis of the Bone, but ſtands obliquely backwards from it.——The Extent of the Head is diſtinguiſhed by a circular *Foſſa* ſurrounding its Baſe, where the Head is united to the Bone, and from which the capſular Ligament of the Joint riſes.——Below the Fore-part of its Baſe two Tubercles ſtand out: The ſmalleſt one, which is ſituated moſt to the Inſide, has the Tendon of the *ſubſcapularis* Muſcle inſerted into it.——The larger more external Protuberance is divided, at its upper Part, into three ſmooth plain Surfaces: Into the anterior of which, the *Muſculus ſupra-ſpinatus*; into the middle or largeſt, the *infra-ſpinatus*; into the one behind, the *Teres minor*, is inſerted.——Between theſe two Tubercles, exactly in the Fore-part of the Bone, a deep long *Foſſa* is formed, for lodging the tendinous Head of the *Biceps flexor cubiti;* which, after paſſing, in a Manner peculiar to itſelf, through the Cavity of the Articulation, is tied down by a tendinous Sheath extended acroſs the *Foſſa;* in which, and in the neighbouring Tubercles, are ſeveral remarkable Holes, which are penetrated by the tendinous and ligamentous Fibres, and by Veſſels.——On each Side of this *Foſſa*

[†] Ἀκρολία, ὠλένη, Os brachii, armi, adjutorium, parvum brachium, cana brachii.

[*] Acrocolium.

as it deſcends in the *Os humeri*, a rough Ridge, gently flatted in the Middle, runs from the Roots of the Tubercles.——The Tendon of the *pectoral* Muſcle is fixed into the anterior of theſe Ridges, and the *latiſſimus Dorſi*, and *Teres major*, are inſerted into the internal one. ——A little behind the lower End of this laſt, another rough Ridge may be obſerved, where the *Coraco-brachialis* is inſerted.——From the Back-part of the Root of the largeſt Tubercle, a Ridge alſo is continued, from which the *Brevis extenſor cubiti* riſes.——This Bone is flatted on the Inſide, about its Middle, by the Belly of the *Biceps flexor cubiti*.——In the Middle of this plain Surface, the Entry of the medullary Artery is ſeen ſlanting obliquely downwards. ——At the Fore-ſide of this Plane the Bone riſes in a Sort of Ridge, which is rough, and often has a great many ſmall Holes in it, where the Tendon of the ſtrong *Deltoid* Muſcle is inſerted; on each Side of which the Bone is ſmooth and flat, where the *Brachiæus internus* riſes. The exterior of theſe two flat Surfaces is the largeſt; behind it a ſuperficial ſpiral Channel, formed by the *Muſcular* Nerve and the Veſſels that acompany it, runs from behind forwards and downwards.——The Body of the *Os humeri* is flatted behind by the Extenſors of the Fore-arm.——Near the lower End of this Bone, a large ſharp Ridge is extended on its Out-ſide, from which the *Muſculus ſpinator radii longus* and the longeſt Head of the *Extenſor carpi radialis* riſe.——Oppoſite to this, there is another ſmall Ridge to which the *aponeurotic* Tendon, that gives

Origin to the Fibres of the internal and external *Brachiæi* Muſcles is fixed; and from a little Depreſſion on the Fore-ſide of it, the *Pronator radii teres* riſes.

The Body of the *Os humeri* becomes gradually broader towards the lower End, where it has ſeveral Proceſſes; at the Roots of which, there is a Cavity before, and another behind *. The anterior is divided by a Ridge into two; the external, which is the leaſt, receives the End of the *Radius*; and the internal receives the *Coronoid* Proceſs of the *Ulna* in the Flexions of the Fore-arm, while the poſterior deep triangular Cavity lodges the *Olecranon* in the Extenſions of that Member.——The Bone betwixt theſe two Cavities is preſſed ſo thin by the Proceſſes of the *Ulna*, as to appear diaphanous in ſeveral Subjects.——The Sides of the poſterior Cavity are ſtretched out into two Proceſſes, one on each Side: Theſe are called *Condyles*; from each of which a ſtrong Ligament goes out to the Bones of the *Fore-arm*.——The external *Condyle*, which has an oblique Direction alſo forwards in reſpect of the internal, when the Arm is in the moſt natural Poſture (*a*) is equally broad, and has an obtuſe ſmooth Head riſing from it forwards.——From the rough Part of the *Condyle*, the inferior Head of the *Bicornis*, the *Extenſor digitorum communis*, *Extenſor carpi ulnaris*, *Anconæus*, and ſome Part of the *Supinator radii brevis* take their Riſe; and on the ſmooth

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* Βαθμίδες.

(*a*) *Winſlow*, Memoires de l'Acad. des Sciences, 1722.

Head the upper End of the *Radius* plays.—— Immediately on the Outſide of this, there is a Sinuoſity made by the ſhorter Head of the *Bicornis* Muſcle, upon which the *Muſcular* Nerve is placed.——The internal *Condyle* is more pointed and protuberant than the external, to give Origin to ſome part of the *Flexor carpi radialis*, *Pronator radii teres*, *Palmaris longus*, *Flexor digitorum ſublimis*, and *Flexor carpi ulnaris*.--Between the two *Condyles*, is the *Trochlea*, or Pully, which conſiſts of two lateral Protuberances, and a middle Cavity, that are ſmooth and covered with Cartilage.—When the Fore-arm is extended, the Tendon of the internal *Brachiæus* Muſcle is lodged in the Fore-part of the Cavity of this Pully.—The external Protuberance, which is leſs than the other, has a ſharp Edge behind; but forwards, this Ridge is obtuſe, and only ſeparated from the little Head, already deſcribed, by a ſmall *Foſſa*, in which the joined Edges of the *Ulna* and *Radius* move.——The internal Protuberance of the Pully is largeſt and higheſt; and therefore in the Motions of the *Ulna* upon it, that Bone would be inclined outwards, was it not ſupported by the *Radius* on that Side.—— Between this internal Protuberance and *Condyle*, a Sinuoſity may be remarked, where the *ulnar* Nerve paſſes.

The Subſtance and the internal Structure of the *Os humeri* is the ſame, and diſpoſed in the ſame Way, as in other long Bones.

The round Head at the upper End of this Bone is articulated with the *Glenoid* Cavity of the *Scapula*; which being ſuperficial, and having long Ligaments, allows the Arm a free and extenſive Motion.—— Theſe Ligaments are however conſiderably ſtrong: For, beſides the common capſular one, the Tendons of the Muſcles perform the Office, and have been deſcribed under the Name of *Ligaments*.—— Then the *Acromion* and *Coracoid* Proceſs, with the ſtrong broad Ligaments ſtretched betwixt them, ſecure the Articulation above, where the greateſt and moſt frequent Force is applied to thruſt the Head of the Bone out of its Place. It is true, that there is not near ſo ſtrong a Defence at the lower Part of the Articulation; but in the ordinary Poſtures of the Arm, that is, ſo long as it is at an acute Angle with the Trunk of the Body, there cannot be any Force applied at this Place to occaſion a Luxation, ſince the Joint is protected ſo well above.

The Motions which the Arm enjoys by this Articulation, are to every Side; and by the Succeſſion of theſe different Motions, a Circle may be deſcribed. Beſides which, the Bone performs a ſmall Rotation round its own *Axis*. But though this can be performed with the round Head in all Poſitions; yet as theſe vary, the Effects upon the Body of the Bone are very different: For, if the Middle of the Head is the Center of Rotation, as it is when the Arm hangs down by the Side, the Body of the Bone is only moved forwards and backwards; becauſe the *Axis* of Motion of the Head is nearly at right Angles with the Length of the Bone (*a*); whereas when the Arm is

raiſed

(*a*) *Hippocrat.* de Articul. § 1.

raiſed to right Angles with the Trunk of the Body, the Center of Motion, and the Axis of the Bone, come to be in the ſame ſtreight Line; and therefore the Body of the *Os humeri* performs the ſame Motion with its Head.—— Though the Motions of the Arm ſeem to be very extenſive, yet the larger Share of them depends on the Motion of the *Scapula.*—— The lower End of the *Os humeri* is articulated with the Bones of the Fore-arm, and carries them with it in all its Motions, but ſerves as a Baſe on which they perform the Motions peculiar to themſelves; as ſhall be deſcribed afterwards.

Both the Ends of this Bone are cartilaginous in a new-born Infant, and the large Head with the two Tubercles, and the *Trochlea* with the two *Condyles*, become *Epiphyſes* before they are united to the Body of the Bone.

The *FORE-ARM* [*] conſiſts of two long Bones, the *Ulna* and *Radius*; whoſe Situation, in reſpect of each other, is oblique in the leaſt ſtraining or moſt natural Poſture; that is, the *Ulna* is not directly behind, nor on the Outſide of the *Radius*, but in a middle Situation between theſe two, and the *Radius* croſſes it.——The Situation however of theſe two Bones, and of all the other Bones of the *ſuperior Extremity* that are not yet deſcribed, is frequently altered; and therefore, to ſhun Repetitions, I deſire it may be now remarked, that, in the remaining Account of the *ſuperior Extremity*, I underſtand by the Term of *poſterior*, that Part which is in the ſame Direction with the Back of the Hand; by *anterior*, that anſwering to the Palm; by *internal*, that on the ſame Side with the Thumb; by *external*, the Side neareſt to the little Finger; ſuppoſing the Hand always to be in a middle Poſition between *Pronation* and *Supination*.

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[*] Cubitus, πῆχυς, ὠλένη, πυγὼν, Ulna, lacertus.

ULNA[†], ſo named from its being uſed as a Meaſure, is the longeſt of the two Bones of the Fore-arm, and ſituated on the Outſide of the *Radius*.

At the upper End of the *Ulna* are two Proceſſes.—— The poſterior is the largeſt, and formed like a Hook, whoſe concave Surface moves upon the Pully of the *Os humeri*, and is called *Olecranon*[‖], or Top of the Cubit. ——The convex Back-part of it is rough and ſcabrous, where the *Longus Brevis*, and *Brachiæus externus*, are inſerted. The *Olecranon* makes it unneceſſary that the Tendons of the extenſor Muſcles ſhould paſs over the End of the *Os humeri;* which would have been of ill Conſequence in the great Flexions of this Joint, or when any conſiderable external Force is applied to this Part (*a*).——The anterior Proceſs is not ſo large, nor does it reach ſo high, as the one behind; but it is ſharper at its End, and therefore is named *Coronoid*.——Between theſe two Proceſſes, a large ſemicircular or *ſigmoid* Concavity is left; the Surface of which, on each Side of a middle Riſing, is ſlanting, and exactly adapted to the Pully of the Bone of the Arm.——Acroſs the middle of it, there is a ſmall Sinuoſity for lodging mucilaginous Glands; where, as well as in a ſmall Hollow on the internal Side of it, the Cartilage that lines the reſt of its Surface is wanting.——Round the Brims of this Concavity the Bone is rough, where the capſular Ligament of the Joint is implanted.——Immediately below the *Olecranon* on the Back-part of the *Ulna*, a flat triangular ſpongy Surface appears, on which we commonly lean.——At the internal Side of this, there is a larger hollow Surface, where the *Muſculus Anconæus* is lodged; and the Ridge at the Inſide of this gives Riſe to the *Muſculus ſupinator radii brevis.*—— Between the Top of the Ridge and the *coronoid* Proceſs is the ſemilunated ſmooth Cavity, lined with Cartilage, in which, and a Ligament extended from the one to the other End of this Cavity, the round Head of the *Radius* plays. ——Immediately below it a rough Hollow gives Lodging to mucaginous Glands.——Below the Root of the *coronoid* Proceſs, this Bone is ſcabrous and unequal, where the *Brachiæus internus* is inſerted.——On the Outſide of that we obſerve a ſmooth Concavity, where the Beginning of the *Flexor digitorum profundus* ſprouts out.

[†] Cubitus, *πῆχυς*, *προπήχιον*, Focile majus, Canna vel arundo major & inferior Brachii.

[‖] Ἀγκῶν, Gibber, Cubitus, Additamentum necatum.

(*a*) *Winſlow*. Expoſition Anatomique du Corps humain, Traitè des os ſecs, § 979.

The Body of the *Ulna* is triangular.——The internal Angle is very ſharp, where the Ligament that connects the two Bones is fixed;

ed;——The Sides, which make this Angle, are flat and rough, by the Action and Adheſion of the many Muſcles which are ſituated here.——At the Diſtance of one Third of the Length of the *Ulna* from the Top, in its Forepart, the Paſſage of the medullary Veſſels is to be remarked ſlanting upwards.——The external Side of this Bone is ſmooth, ſomewhat convex, and the Angles at each Edge of it are blunted by the Preſſure of the Muſcles equally diſpoſed about them.

As this Bone deſcends, it becomes gradually ſmaller; ſo that its lower End terminates in a little Head, ſtanding on a ſmall Neck.——Towards the fore but outer Part of which laſt, an oblique Ridge runs, that gives Riſe to the *Pronator radii quadratus*.——The Head is round, ſmooth, and covered with a Cartilage on its internal Side, to be received into the ſemilunar Cavity of the *Radius*; while a *ſtyloid* Proceſs † riſes from its Outſide, to which is fixed a ſtrong Ligament that is extended to the *Os cuneiforme* and *piſiforme* of the Wriſt.——Between the Back-part of that internal ſmooth Side and this Proceſs, a Sinuoſity is left for the Tendon of the *Extenſor carpi ulnaris*.——On the Fore-part of the Root of the Proceſs, ſuch another Depreſſion may be remarked for the Paſſage of the *ulnar* Artery and Nerve.——The End of the Bone is ſmooth, and covered with a Cartilage.——Between it and the Bones of the Wriſt, a doubly-concave moveable Cartilage is interpoſed; which is a

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† Γραφοειδῆ, Malleolus externus.

Continuation of the Cartilage that covers the lower End of the *Radius*, and is connected looſely to the Root of the *ſtyloid* Proceſs, and to the rough Cavity there; in which mucaginous Glands are lodged.

The *Ulna* is articulated above with the lower End of the *Os humeri*, where theſe Bones have Depreſſions and Protuberances correſponding to each other, ſo as to allow an eaſy and ſecure Extenſion of the Fore-arm to almoſt a ſtreight Line with the Arm, and Flexion to a very acute Angle; but, by the ſlanting Poſition of the Pully, the lower Part of the Fore-arm is turned outwards in the Extenſion, and inwards in the Flexion (*a*); and a very ſmall kind of Rotation is likewiſe allowed in all Poſitions, eſpecially when the Ligaments are moſt relaxed by the Fore-arm being in a middle Degree of Flexion.——The *Ulna* is alſo articulated with the *Radius* and *Corpus*, in a manner to be related afterwards.

RADIUS †, ſo called from its imagined Reſemblance to a Spoke of a Wheel, or to a Weaver's Beam, is the Bone placed at the Inſide of the Fore-arm. Its upper End is formed into a circular little Head, which is hollowed for an Articulation with the Tubercle at the Side of the Pulley of the *Os humeri;* and the Half of the round Circumference of the Head next to the *Ulna* is ſmooth, and covered with a Cartilage, in order to be received into the ſemilu-

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(*a*) *Winſlow*, Memoires de l'Acad. des Sciences, 1722.

† Κερκὶς, παραπήχιον, Focile minus, Canna minor, Arund minor.

nated Cavity of that Bone.——Below the Head, the *Radius* is much ſmaller; therefore this Part is named its *Cervix*, which is made round by the Action of the *Supinator radii brevis.*——At the external Root of this Neck, a tuberous Proceſs riſes; into the outer Part of which the *Biceps flexor cubiti* is inſerted.——From this a Ridge runs downwards and inwards, where the *Supinator radii brevis* is inſerted; and a little below, and behind this Ridge, there is a rough ſcabrous Surface, where the *Pronator radii teres* is fixed.

The Body of the *Radius* is not ſtreight, but convex on its internal and poſterior Surfaces; where it is alſo made round by the equal Preſſure of the circumjacent Muſcles, particularly of the *Extenſors* of the Thumb; but the Surfaces next to the *Ulna* are flatted and rough, for the Origin of the Muſcles of the Hand; and both terminate in a common ſharp Spine, to which the ſtrong Ligament extended betwixt the two Bones of the Fore-arm is fixed.——A little below the Beginning of the plain Surface, on its Fore-part, where the *Flexor* Muſcle of the laſt Joint of the Thumb takes its Origin, the Paſſage of the medullary Veſſels is ſeen ſlanting upwards.—The *Radius* becomes broader and flatter towards the lower End, eſpecially on its Fore-part, where its *Pronator quadratus* Muſcle is ſituated.

The lower End of the *Radius* is larger than the ſuperior; though not in ſuch a Diſproportion, as the upper End of the *Ulna* is larger than its lower End.——Its Back-part has a flat ſtrong Ridge in the Middle, and *Foſſæ* on each Side.—In a ſmall Groove, immediately on the Outſide of the Ridge, the Tendon of the *Extenſor tertii internodii pollicis* plays.——In a large one beyond this, the Tendons of the *Indicator* and of the common *Extenſor* Muſcles of the Fingers paſs——Contiguous to the *Ulna*, there is a ſmall Depreſſion made by the *Extenſor minimi digiti.*——On the Inſide of the Ridge there is a broad Depreſſion, which ſeems again ſubdivided, where the two Tendons of the *Bicornis*, or *Extenſor carpi radialis*, are lodged.——The internal Side of this End of the *Radius*, is alſo hollowed by the Extenſors of the firſt and ſecond Joint of the Thumb; immediately above which, a little rough Surface ſhews where the *Supinator radii longus* is inſerted.——The Ridges at the Sides of the Grooves, in which the Tendons play, have an annular Ligament fixed to them, by which the ſeveral Sheaths for the Tendons are formed.——The Fore-part of this End of the *Radius* is alſo depreſſed, where the Flexors of the Fingers and *Flexor carpi radialis* paſs.——The external Side is formed into a ſemilunated ſmooth Cavity, lined with a Cartilage, for receiving the lower End of the *Ulna*.——The loweſt Part of the *Radius* is formed into an oblong Cavity; in the Middle of which is a ſmall tranſverſe Riſing, gently hollowed, for lodging mucilaginous Glands; while the Riſing itſelf is inſinuated into the Conjunction of the two Bones of the Wriſt that are received here.——The internal Side of this Articulation is fenced by a remarkable Proceſs * of the *Radius*, from which a Ligament goes out to the Wriſt as the *ſtyloid*

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* Malleolus internus, Proceſſus ſtyloides.

ſtyloid Proceſs of the *Ulna* with its Ligament guards it on the Outſide.

The Ends of both the Bones of the Fore-arm being thicker than the Middle, there is a conſiderable Diſtance between the Bodies of theſe Bones; in the larger Part of which a ſtrong tendinous, but thin Ligament, is extended, to give a large enough Surface for the Origin of the numerous Fibres of the Muſcles ſituated here, that are ſo much ſunk between the Bones, as to be protected from Injuries, which they would otherwiſe be expoſed to. But this Ligament is wanting near the upper End of the Fore-arm, where the *Supinator radii brevis*, and *Flexor digitorum profundus*, are immediately connected *(a)*.

Both Ends of the Bones of the Fore-arm, are firſt Cartilages, and then *Epiphyſes* in Children.

As the head of the *Radius* receives the Tubercle of the *Os humeri*, it is not only bended and extended along with the *Ulna*, but may be moved round its *Axis* in any Poſition; and that this Motion round its *Axis* may be ſufficiently large, the Ligament of the Articulation is extended farther down than ordinary on the Neck of this Bone, before it is connected to it; and it is very thin at its upper and lower Part, but makes a firm Ring in the Middle.——This Bone is alſo joined to the *Ulna* by a double Articulation; for above a Tubercle of the *Radius* plays in a Socket of the *Ulna*, whilſt below the *Radius* gives the Socket and the *Ulna* the Tubercle:

(a) *Weitbrecht.* Syndeſmolog. Fig. 10. 11.

But then the Motion performed in theſe two is very different; for at the upper End, the *Radius* does no more than turn round its Axis; while at the lower End, it moves in a ſort of *Cycloid*, upon the round Part of the *Ulna;* and as the Hand is articulated and firmly connected here with the *Radius*, they muſt move together—— When the Palm is turned uppermoſt, the *Radius* is ſaid to perform the *Supination*; when the Back of the Hand is above, it is ſaid to be *Prone*. But then the Quickneſs and large Extent of theſe two Motions are aſſiſted by the *Ulna*, which, as was before obſerved, can move with a kind of ſmall Rotation on the ſloping Sides of the Pulley. This lateral Motion, tho' very inconſiderable in the Joint itſelf, is conſpicuous at the lower End of ſuch a long Bone; and the ſtrong Ligament connecting this lower End to the *Carpus*, makes the Hand more readily to obey theſe Motions.——When we deſign a large circular Turn of our Hand, we increaſe it by the Rotation of the *Os humeri*, and ſometimes employ the Spine and *inferior Extremities*, to make theſe Motions of Pronation and Supination of the Hand large enough.

The *HAND* * comprehends all from the Joint of the Wriſt to the Points of the Fingers. Its Back-part is convex, for greater Firmneſs and Strength; and it is concave before, for containing more ſurely and conveniently ſuch Bodies as we take hold of:——One Half of the Hand has an obſcure Motion in Compariſon of what the other has, and ſerves as a Baſe to the moveable Half; which can be extended back very little farther than to a ſtreight Line with the Fore-arm, but can be conſiderably bended forwards.

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* Ἀκρόχειρ, ſumma Manus.

As the Bones that compoſe the Hand are of different Shapes and Uſes, while ſeveral of them that are contiguous agree in ſome general Characters; the Hand is, on this Account, commonly divided into the *Carpus*, *Metacarpus*, and *Fingers*; among which laſt the Thumb is reckoned.

The *CARPUS* * is compoſed of eight ſmall ſpongy Bones, ſituated at the upper Part of the Hand. I ſhall deſcribe each of theſe Bones, under a proper Name taken from their Figure *(a)*, becauſe the Method of ranging them by Numbers, leaves Anatomiſts too much at liberty to debate, very idly, which ought to be preferred to the firſt Number; or, which is worſe, ſeveral, without explaining the Order they obſerve, differently apply the ſame Numbers, and ſo confound their Readers.——But that the Deſcription of theſe Bones may be in the ſame Order as they are found in the Generality of Anatomical Books, I ſhall begin with the Range of Bones that are concerned in the moveable Joint of the Wriſt, or are connected to the Fore-arm, and ſhall afterwards conſider the four that ſupport the Thumb and *Oſſa Metacarpi* of the Fingers.

The eight Bones of the *Carpus* are, *Os ſcaphoides*, *lunare*, *cuneiforme*, *piſiforme*, *trapezium*, *trapezoides*, *magnum*, *unciforme*.

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† Krè, Brachiale, prima palmæ pars, Raſetta.
(a) *Lyſer*. Cult. Anat. lib. 5. cap. 2.

The *Scaphoides* is ſituated moſt internally of thoſe that are articulated with the Fore-arm.—The *Lunare* is immediately on the Outſide of the former.——The *Cuneiforme* is placed ſtill more externally, but does not reach ſo high up as the other two.——The *Piſiforme* ſtands forwards into the Palm from the *Cuneiforme*.—The *Trapezium* is the firſt of the ſecond Row, and is ſituated betwixt the *Scaphoides* and firſt Joint of the Thumb.——The *Trapezoides* is immediately on the Outſide of the *Trapezium*.——The *Os magnum* is ſtill more external;——The *Unciforme* is fartheſt to the Side of the Little-finger.

Os Scaphoides * is the largeſt of the eight except one. It is convex above, concave and oblong below; from which ſmall Reſemblance of a Boat it has got its Name.——Its ſmooth convex Surface is divided by a rough middle *Foſſa*, which runs obliquely croſs it.——The upper largeſt Diviſion is articulated with the *Radius*.—Into the *Foſſa* the common Ligament of the Joint of the Wriſt is fixed; and the lower Diviſion is joined to the *Trapezium* and *Trapezoides*.——The Concavity receives more than an Half of the round Head of the *Os magnum*——The external Side of this Hollow is formed into a ſemilunar Plane, to be articulated with the following Bone.——The internal, poſterior and anterior Edges, are rough, for fixing the Ligaments that connect it to the ſurrounding Bones.

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* Κοτυλοειδὲς, Naviculare.

Os lunare † has a ſmooth convex upper Surface, by which it is articulated with the *Radius.*——The internal Side, which gives the Name to the Bone, is in the Form of a Creſcent, and is joined with the *Scaphoid*;——the lower Surface is hollow, for receiving part of the Head of the *Os magnum.*——On the Outſide of this Cavity is another ſmooth, but narrow oblong Sinuoſity, for receiving the upper End of the *Os unciforme*:——on the Outſide of which a ſmall round Convexity is found, for its Connexion with the *Os cuneiforme.*——Between the great Convexity above, and the firſt deep inferior Cavity, there is a rough *Foſſa*, in which the circular Ligament of the Joint of the Wriſt is fixed.

Os cuneiforme * is broader above, and towards the Back of the Hand, than it is below and forwards; which gives it the Reſemblance of a Wedge.——The ſuperior ſlightly convex Surface is included in the Joint of the Wriſt, being oppoſed to the lower End of the *Ulna.*——Below this the cuneiform Bone has a rough *Foſſa*, wherein the Ligament of the Articulation of the Wriſt is fixed.——On the internal Side of this Bone, where it is contiguous to the *Os lunare*, it is ſmooth and ſlightly concave.——Its lower Surface, where it is contiguous to the *Os unciforme* is oblong, ſomewhat ſpiral, and concave.——Near the Middle of its anterior Surface a circular Plane appears, where the *Os piſiforme* is ſuſtained.

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† Lunatum.

* Triquetrum.

Os piſiforme † is almoſt ſpherical, except one circular Plane, or ſlightly hollow Surface, which is covered with Cartilage for its Motion on the *cuneiform* Bone, from which its whole rough Body is prominent forwards into the Palm; having the Tendon of the *Flexor carpi ulnaris*, and a Ligament from the *ſtyloid* Proceſs of the *Ulna*, fixed to its upper Part; the *tranſverſe* Ligament of the Wriſt is connected to its internal Side; Ligaments extended to the *unciform* Bone, and to the *Os metacarpi* of the Little-finger, are attached to its lower Part; and the *Abductor minimi digiti* has its Origin from its Fore-part; and, at the internal Side of it, a ſmall Depreſſion is formed, for the Paſſage of the ulnar Nerve.

Trapezium * has four unequal Sides and Angles in its Back-part, from which it has got its Name.——Above, its Surface is ſmooth, ſlightly hollowed, and ſemicircular, for its Conjunction with the *Os ſcaphoides*.——Its external Side is an oblong concave Square, for receiving the following Bone.——The inferior Surface is formed into a Pulley; the two protuberant Sides of which are external and internal. On this Pulley the firſt Bone of the Thumb is moved.——At the external Side of the external Protuberance, a ſmall oblong ſmooth Surface is formed by the *Os metacarpi indicis*.——The Fore-part of the *Trapezium* is prominent in the Palm, and, near to the external Side, has a Sinuoſity in it, where the

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† Cartilaginoſum, ſubrotundum, rectum.

* Os cubiforme, trapezoides, multangulum majus.

Tendon of the *Flexor carpi radialis* is lodged; on the ligamentous Sheath of which the Tendon of the *Flexor tertii internodii pollicis* plays: And ſtill more externally the Bone is ſcabrous, vhere the *tranſverſe* Ligament of the Wriſt s connected, the *Adductor* and *Flexor primi nternodii pollicis* have their Origin, and Liganents go out to the firſt Bone of the Thumb.

Os trapezoides *, ſo called from the irregular quadrangular Figure of its Back-part, s the ſmalleſt Bone of the Wriſt, except the *Piſiforme.*——The Figure of it is an irreguar Cube.——It has a ſmall hollow Surface above, by which it joins the *Scaphoides;* a long convex one internally, where it is contiguous o the *Trapezium*; a ſmall external one, for ts Conjunction with the *Os magnum;* and an nferior convex Surface, the Edges of which re however ſo raiſed before and behind, that ſort of Pulley is formed, where it ſuſtains he *Os metacarpi indicis.*

Os magnum †, ſo called becauſe it is the argeſt Bone of the *Carpus*, is oblong, having our quadrangular Sides, with a round upper End, and a triangular plain one below.——The round Head is divided by a ſmall Riſing, ppoſite to the Connection of the *Os ſcaphoides* nd *lunare*, which together form the Cavity or receiving it.——On the Inſide a ſhort plain urface joins the *Os magnum* to the *Trapezoides.*——On the Outſide is a long narrow concave urface, where it is contiguous to the *Os unciforme.*

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* Trapezium, multangulum minus.

† Maximum. capitatum.

forme.——The lower End, which ſuſtains the metacarpal Bone of the Middle-finger, is triangular, ſlightly hollowed, and farther advanced on the internal Side than on the external, having a conſiderable oblong Depreſſion made on the advanced Inſide by the metacarpal Bone of the Fore-finger; and generally there is a ſmall Mark of the *Os metacarpi digiti annularis* on its external Side.

Os unciforme † has got its Name from a thin broad Proceſs that ſtands out from it forwards into the Palm, and is hollow on its Inſide, for affording Paſſage to the Tendons of the Flexors of the Fingers. To this Proceſs alſo the tranſverſe Ligament is fixed, that binds down and defends theſe Tendons; and the *Flexor* and *Abductor* Muſcles of the Little-finger have part of their Origin from it.——The upper plain Surface is ſmall, convex, and joined with the *Os lunare*:——The internal Side is long, and ſlightly convex, adapted to the contiguous *Os magnum*:——The external Surface is oblique, and irregularly convex, to be articulated with the cuneiform Bone:——The lower End is divided into two concave Surfaces; the external is joined with the metacarpal Bone of the Little-finger, and the internal one is fitted to the metacarpal Bone of the Ring-finger.

In the Deſcription of the preceeding eight Bones, I have only mentioned thoſe plain Surfaces covered with Cartilage, by which they are articulated to each other, or to ſome other Bones, except in ſome few Caſes, where ſomething extraordinary was to be obſerved; and I have deſignedly omitted the other rough Surfaces, leſt, by crowding too many Words in the Deſcription of ſuch ſmall Bones, the whole ſhould be unintelligible: But theſe ſcabrous Parts of the Bones may eaſily be underſtood, after mentioning their Figure, if it is obſerved, that they are generally found only towards the Back or Palm of the Hand; that they are all plain, larger behind than before; and that they receive the different Ligaments, by which they are either connected to neighbouring Bones, or to one another; for theſe Ligaments cover all the Bones, and are ſo accurately applied to them, that, at firſt View, the whole *Carpus* of a recent Subject appears one ſmooth Bone (*a*).

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† Cuneiforme.

As the Surfaces of theſe Bones are largeſt behind, the Figure of the whole conjoined muſt be convex there, and concave before; which Concavity is ſtill more increaſed by the *Os piſiforme*, and Proceſs of the *Os unciforme*, ſtanding forwards on one Side, as the *Trapezium* does on the other: And the Bones are ſecurely kept in this Form, by the broad ſtrong tranſverſe Ligament connected to theſe Parts of them that ſtand prominent into the Palm of the Hand.——The Convexity behind renders the whole Fabric ſtronger, where it is moſt expoſed to Injuries; and the large anterior

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(*a*) *Galen*, de uſu Part. lib. 2. cap. 8. For a particular Deſcription of theſe Ligaments, ſee *Weitbrecht*. Syndeſmolog. p. 35. –68.

terior Hollow is neceſſary for a ſafe Paſſag to the numerous Veſſels, Nerves, and Tendons of the Fingers.

The Subſtance of theſe Bones is ſpong and cellular, but ſtrong in reſpect of thei Bulk.

The three firſt Bones of the *Carpus* mak an oblong Head, by which they are articulate with the Cavity at the lower Ends of the Bone of the Fore-arm; ſo as to allow Motion t all Sides, and, by a quick Succeſſion of theſ Motions, they may be moved in a Circle But as the Joint is oblong, and therefore the two Dimenſions are unequal, no Motion i allowed to the *Carpus* round its Axis, excep what it has in the Pronation and Supinatio along with the *Radius*.——The Articulatio of the firſt three Bones of the ſuperior Row with the Bones of the inferior, is ſuch as allows of Motion, eſpecially backwards an forwards; to the Security and Eaſineſs o which the Reception of the *Os magnum* int the Cavity formed by the *Scaphoides* and *Lunare* contributes conſiderably: And the greateſt Number of the Muſcles that ſerve for the Motion of the Wriſt on the *Radius*, being inſerted beyond the Conjunction of the firſt Row of Bones with the ſecond, act equally on this Articulation as they do on the former; but the Joint formed with the *Radius* being the moſt eaſily moved, the firſt Effect of theſe Muſcles is on it; and the ſecond Row of the *Carpus* is only moved afterwards. By this means a larger Motion of the Wriſt is allow-

ed.

l than otherwiſe it could have had ſafely:
or, if as large Motion had been given to one
oint, the Angle of Flexion would have been
ery acute, and the Ligaments muſt have been
nger than was conſiſtent with the Firmneſs
nd Security of the Joint.——The other Ar-
culations of the Bones here being by nearly
ain Surfaces, ſcarce allow of any more Mo-
on, becauſe of the ſtrong connecting Liga-
ents, than to yield a little, and ſo elude the
orce of any external Power; and to render
e Back of the Wriſt a little more flat, or the
lm more hollow, on proper Occaſions.
he Articulations of the Thumb and metacar-
l Bones ſhall be examined afterwards.

The Uſes of the *Carpus* are, to ſerve as a
ſe to the Hand, to protect its Tendons, and
afford it a free large Motion.

All the Bones of the *Carpus* are in a carti-
inous State at the Time of Birth.

On Account of the many Tendons that paſs
on the lower End of the Fore-arm and the
rpus, and of the numerous Ligaments of
eſe Tendons and of the Bones, which have
ricating Liquors ſupplied to them, the Pain
Sprains here is acute, the Parts take long
me to recover their Tone, and their Swel-
gs are very obſtinate.

METACARPUS † conſiſts of four Bones
ich ſuſtain the Fingers.——Each Bone is
g and round, with its Ends larger than its
dy.——The Upper End, which ſome call the
Baſe,

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† Κτεὶς, προκάρπιοι, ϛῆθος, ἄνδηρον, κτενίον, poſtbrachiale,
us, palma, pecten.

Baſe, is flat and oblong, without any conſid
rable Head or Cavity; but it is however ſom
what hollowed, for the Articulation with t
Carpus: It is made flat and ſmooth on the Sid
where theſe Bones are contiguous to each
ther.——Their Bodies are flatted on their Bac
part by the Tendons of the Extenſors of t
Fingers.——The anterior Surface of the
Bodies is a little concave, eſpecially in the
Middle; along which a ſharp Ridge ſtan
out, which ſeparates the *muſculi interoſſei* plac
on each Side of theſe Bones, which are the
made flat and plain by theſe Muſcles.

Their lower Ends are raiſed into large o
long ſmooth Heads, whoſe greateſt Extent is fo
wards from the Axis of the Bone.—At the For
part of each Side of the Root of each of the
Heads, one or two Tubercles ſtand out, for fixi
the Ligaments that go from one metacar
Bone to another, to preſerve them from b
ing drawn aſunder:——Round the Heads
rough Ring may be remarked, for the cap
lar Ligaments of the firſt Joints of the Finge
to be fixed to; and both Sides of theſe Hea
are flat, by preſſing on each other.

The Subſtance of the metacarpal Bones
the ſame with that of all long Bones.

At the Time of Birth, theſe Bones are ca
tilaginous at both Ends, which afterwards b
come *Epiphyſes*.

The metacarpal Bones are joined above
the *Oſſa Carpi* and to each other by nea
plain Surfaces. Theſe Connexions are n
fit for large Motions——The Articulation
their round Heads at the lower Ends with t

Cavities of the firſt Bones of the Fingers, is to be taken Notice of hereafter.

The Concavity on the Fore-part of theſe metacarpal Bones, and the placing their Baſes on the arched *Carpus*, cauſe them to form a Hollow in the Palm of the Hand, which is uſeful often to us.——The Spaces between them lodge Muſcles, and their ſmall Motion makes them fit Supporters for the Fingers to play on.

Though the *Oſſa metacarpi* ſo far agree, yet they may be diſtinguiſhed from each other by the following Marks.

The *Os metacarpi indicis* is generally the longeſt.——Its Baſe, which is articulated with the *Os trapezoides*, is hollow in the Middle. ——The ſmall Ridge on the internal Side of this oblong Cavity is ſmaller than the one oppoſite to it, and is made flat on the Side by the *Trapezium*.——The exterior Ridge is alſo ſmooth, and flat on its Outſide, for its Conjunction with the *Os magnum*; immediately below which a ſemicircular ſmooth flat Surface ſhews the Articulation of this to the ſecond metacarpal Bone.——The Back-part of this Baſe is flatted, where the long Head of the *Extenſor carpi radialis* is inſerted; and its Fore-part is prominent, where the Tendon of the *Flexor carpi radialis* is fixed.——The external Side of the Body of this Bone is more hollowed by the Action of Muſcles, than the internal——The Tubercle at the internal Root of its Head is larger than the external.——Its Baſe is ſo firmly fixed to the Bones it is connected with, that it has no Motion.

Os metacarpi medii digiti is generally the ſecond in Length; but often it is as long as the former; ſometimes it is longer; and frequently it only appears to equal the firſt by the *Os magnum* being farther advanced downwards than any other Bone of the Wriſt.——Its Baſe is a broad ſuperficial Cavity, ſlanting outwards; the internal poſterior Angle of which is ſo prominent, as to have the Appearance of a Proceſs.——The internal Side of this Baſe is made plain in the ſame Way as the external Side of the former Bone, while its external Side has two hollow circular Surfaces, for joining the third metacarpal Bone; and between theſe Surfaces there is a rough *Foſſa*, for the Adheſion of a Ligament, and lodging mucilaginous Glands.——The ſhorter Head of the *Bicornis* is inſerted into the Back-part of this Baſe.——The two Sides of this Bone are almoſt equally flatted; only the Ridge on the Fore-part of the Body inclines outwards.——The Tubercles at the Fore-part of the Root of the Head are equal.——The Motion of this Bone is very little more than the firſt metacarpal one has; and therefore theſe two firmly reſiſt Bodies preſſed againſt them by the Thumb, or Fingers, or both.

Os metacarpi digiti annularis is ſhorter than the ſecond metacarpal Bone.——Its Baſe is ſemicircular and convex, for its Conjunction with the *Os unciforme*.——On its internal Side are two ſmooth Convexities, and a middle *Foſſa*, adapted to the ſecond metacarpal Bone.——The external Side has a triangular ſmooth concave Surface, to join it with the fourth one. The anterior Ridge of its Body is ſituated more to the Out than to the In-ſide. ——The Tubercles near the Head are equal. —— The Motion of this third metacarpal Bone is greater than the Motion of the ſecond.

Os metacarpi minimi digiti is the ſmalleſt and ſharpeſt.——Its Baſe is irregularly convex, and riſes ſlanting outwards.——Its internal Side is exactly adapted to the third metacarpal Bone.——The external has no ſmooth Surface, becauſe it is not contiguous to any other Bone; but it is prominent where the *Extenſor carpi ulnaris* is inſerted.——As this *Os metacarpi* is furniſhed with a proper moving Muſcle, has the plaineſt Articulation, is moſt looſely connected and leaſt confined, it not only enjoys a much larger Motion than any of the reſt, but draws the third Bone with it, when the Palm of the Hand is to be made hollow by its Advancement forwards, and by the Prominence of the Thumb oppoſite to it.

The *THUMB* and four *FINGERS* are each compoſed of three long Bones.

The *Thumb* * is ſituated obliquely in reſpect of the Fingers, neither oppoſite directly to them, nor in the ſame Plane with them.——All its Bones are much thicker and ſtronger in Proportion to their Length, than the Bones of the Fingers are: Which was extremely neceſſary, ſince the Thumb counteracts all the Fingers.

The firſt Bone of the Thumb has its Baſe adapted to the double Pulley of the *Trapezi-*

* Ἀντίχειρ, δικονδυλὸς, Magnus digitus, promanus.

um: For, in viewing it from one Side to the other, it appears convex in the Middle; but when conſidered from behind forwards, it is concave there.——The Edge at the Fore-part of this Baſe is produced farther than any other Part; and round the Back-part of the Baſe a rough *Foſſa* may be ſeen, for the Connection of the Ligaments of this Joint.——The Body and Head of this Bone are of the ſame Shape as the *Oſſa metacarpi*; only that the Body is ſhorter, and the Head flatter, with the Tubercles at the Fore-part of its Root larger.

The Articulation of the upper End of this Bone is uncommon: For though it has Protuberances and Depreſſions adapted to the double Pulley of the *Trapezium*, yet it enjoys a circular Motion, as the Joints do where a round Head of one Bone plays in the orbicular Socket of another; only it is ſomewhat more confined and leſs expeditious, but ſtronger and more ſecure, than ſuch Joints generally are.

This Bone of Children is in the ſame State with the metacarpal Bones.

The ſecond Bone of the Thumb has a large Baſe formed into an oblong Cavity, whoſe greateſt Length is from one Side to the other. ——Round it ſeveral Tubercles may be remarked, for the Inſertion of Ligaments.—— Its Body is convex, or a Half-round behind; but flat before, for lodging the Tendon of the long Flexor of the Thumb, which is tied down by ligamentous Sheaths that are fixed on each Side to the Angle at the Edge of this flat Surface.——The lower End of this ſecond Bone has two lateral round Protuberances, and a middle Cavity, whoſe greateſt Extent of ſmooth Surface is forwards.

The Articulation and Motion of the upper End of this ſecond Bone is as ſingular as that of the former.——For its Cavity being joined to the round Head of the firſt Bone, it would ſeem at firſt View to enjoy Motion in all Directions; yet becauſe of the Strength of its lateral Ligaments, oblong Figure of the Joint itſelf, and Mobility of the firſt Joint, it only allows Flexion and Extenſion; and theſe are generally much confined.

The third Bone of the Thumb is the ſmalleſt, with a large Baſe, whoſe greateſt Extent is from one Side to the other.——This Baſe is formed into two Cavities and a middle Protuberance, to be adapted to the Pulley of the former Bone.——Its Body is rounded behind; but is flatter than in the former Bone, for ſuſtaining the Nails.——It is flat and rough before, by the Inſertion of the *Flexor tertii internodii.*——This Bone becomes gradually ſmaller, till near the lower End, where it is a little enlarged, and has an oval ſcabrous Edge.

The Motion of this third Bone is confined to Flexion and Extenſion.

The orderly Diſpoſition of the Bones of the *Fingers* into three Rows, has made them generally obtain the Name of three *phalanges* §. ——All of them have half round convex Surfaces, covered with an *Aponeuroſis*, formed by the

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§ Scytalidæ, internodia, ſcuticula, agmina, acies, condyli, articuli.

the Tendons of the *Extenſors*, *Lumbricales*, and *Interoſſei*, and placed directly backwards, for their greater Strength; and their flat concave Part is forwards, for taking Hold more ſurely, and for lodging the Tendons of the Flexor Muſcles.——The Ligaments for keeping down theſe Tendons are fixed to the Angles that are between the convex and concave Sides.

The Bones of the firſt *Phalanx* † of the Fingers anſwer to the Deſcription of the ſecond Bone of the Thumb: Only that the Cavity in their Baſe is not ſo oblong; nor is their Motion on the metacarpal Bones ſo much confined; for they can be moved laterally or circularly, but have no Rotation or a very ſmall Degree of it round their Axes.

Both the Ends of this firſt *Phalanx* are in a cartilaginous State at the Birth; and the upper one is afterwards affixed in Form of an *Epiphyſe*.

The ſecond Bone ‡ of the Fingers has its Baſe formed into two lateral Cavities, and a middle Protuberance; while the lower End has two lateral Protuberances and a middle Cavity; therefore it is joined at both Ends in the ſame Manner, which none of the Bones of the Thumb are.

This Bone is in the ſame Condition with the former in Children.

The third Bone § differs nothing from the

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† Προκόνδυλοι.
‡ Κόνδυλοι.
§ Μετακόνδυλοι, ῥιζωνύχια.

Deſcription of the third Bone of the Thumb, excepting in the general diſtinguiſhing Marks; and therefore the ſecond, and third *Phalanx* of the Fingers enjoy only Flexion and Extenſion.

The upper End of this third *Phalanx* is a Cartilage in a ripe Child; and is only an *Epiphyſe* after, till the full Growth of the Body.

All the Difference of the *Phalanges* of the ſeveral Fingers conſiſts in their Magnitude.—— The Bones of the *Middle-finger* [**] being the longeſt and largeſt,———thoſe of the *Fore-finger* [†] come next to that in Thickneſs, but not in Length, for thoſe of the *Ring-finger* [‡‡] are a little longer. The *Little-finger* [‖] has the ſmalleſt Bones. Which Diſpoſition is the beſt Contrivance for holding the largeſt Bodies; becauſe the longeſt Fingers are applied to the middle largeſt Periphery of ſuch Subſtances as are of a ſpherical Figure *(a)*.

The Uſes of all the Parts of our *ſuperior Extremities* are ſo evident in the common Actions of Life, that it is needleſs to enumerate them here; and therefore I ſhall proceed to the laſt Part of the Skeleton. Only, leſt I ſhould ſeem to have forgot the ſmall Bones at the Joints of the Hand, I deſire now to refer to the Deſcription of them, under the common Title of *Seſamoid Bones*, which I have placed after the Bones of the Feet.

[**] Καταπυγὼν, σφάκελος, infamis, impudicus, verpus, famoſus, obſcænus.

[†] Δεικτικὸς, indicator, λιχανὸς, demonſtrativus, ſalutaris.

[‡‡] Ἰατρικὸς, παράμεσος, δακτυλιώτης, ἐπιβάτης, Annularis, medicus, cordis digitus.

[‖] Μύωψ, ὠτίτης, Auricularis, minimus.

(a) *Galen.* de uſu Part. lib. 1. cap. 24.

Of the INFERIOR EXTREMITIES.

THE *INFERIOR EXTREMITIES* depend from the *Acetabula* of the *Oſſa innominata;* and are commonly divided into three Parts, *viz.* the Thigh, Leg, and Foot.

The *THIGH* * has only one Bone; which is the longeſt of the Body, and the largeſt and ſtrongeſt of any of the cylindrical Bones. The Situation of it is not perpendicular: For the lower End is inclined conſiderably inwards; ſo that the Knees are almoſt contiguous, while there is a conſiderable Diſtance between the Thigh-bones above: Which is of good Uſe to us, ſince ſufficient Space is thereby left for the external Parts of Generation, the two great *Cloacæ* of Urine and *Fæces*, and for the large thick Muſcles that move the Thigh inwards: And at the ſame time this Situation of the Thigh-bones renders our Progreſſion quicker, ſurer, ſtreighter, and in leſs Room; for had the Knees been at a greater Diſtance from each other, we muſt have been obliged to deſcribe ſome Part of a Circle with the Trunk of our Body in making a long Step, and, when one Leg was raiſed from the Ground, our Center of Gravity would have been too far from the Baſe of the other, and we ſhould conſequently have been in Hazard of falling; ſo that our Steps would neither have been ſtreight nor firm; nor would it have been poſſible to walk in a narrow Path, had our Thigh-bones been otherwiſe placed. In Conſequence however of the Weight of the Body bearing ſo obliquely on the Joint of the Knee, by this Situation of the Thigh-bones, weak rickety Children become in-kneed.

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* Μηρὸν, Femen, coxa, agis, anchæ os, crus, femur.

The upper End of the Thigh-bone is not continued in a ſtreight Line with the Body of it, but is ſet off obliquely inwards and upwards, whereby the Diſtance here between theſe two Bones at their upper Part is conſiderably increaſed.——This End is formed into a large ſmooth round Head †, which is the greater Portion of a Sphere unequally divided.——Towards its lower internal Part a round rough ſpongy Pit is obſervable, where the ſtrong Ligament, commonly, but unjuſtly, called the *round* one, is fixed, to be extended from thence to the lower internal Part of the receiving Cavity, where it is conſiderably broader than near to the Head of the Thigh-bone.——The ſmall Part below the Head, called the *Cervix*, of the *Os Femoris*, has a great many large Holes, into which the Fibres of the ſtrong Ligament, continued from the capſular, enter, and are thereby ſurely united to it; and round the Root of the Neck, where it riſes from the Bone, a rough Ridge is found, where the capſular Ligament of the Articulation itſelf is connected.——Below the Back-part of this Root, the large unequal Protuberance,

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† Vertebrum.

tuberance, called *Trochanter major* †, ſtands out; the external convex Part of which is diſtinguiſhed into three different Surfaces, whereof the one on the Fore-part is ſcabrous and rough, for the Inſertion of the *Glutæus minimus;* the ſuperior one is ſmooth, and has the *Glutæus medius* inſerted into it; and the one behind is made flat and ſmooth by the Tendon of the *Glutæus maximus* paſſing over it.——The upper Edge of this Proceſs is ſharp and pointed at its Back-part, where the *Glutæus medius* is fixed; but forwards it is more obtuſe, and has two ſuperficial Pits formed in it: Into the ſuperior of theſe, the *Piriformis* is implanted; and the *Obturator internus* and *Gemini* are fixed into the lower one.——From the backmoſt prominent Part of this great *Trochanter*, a rough Ridge runs backwards and downwards, into which the *Quadratus* is inſerted.——In the deep Hollow, at the internal upper Side of this Ridge, the *Obturator externus* is implanted.——More internally, a conoid Proceſs, called *Trochanter minor* ‡, riſes for the Inſertion of the *Muſculus Pſoas*, and *Iliacus internus*, and the *Pectineus*, is implanted into a rough Hollow below its internal Root.——The Muſcles inſerted into theſe two Proceſſes being the principal Inſtruments of the rotatory Motion of the Thigh, have occaſioned the Name of *Trochanters* to the Proceſſes.——The Tendons that are fixed into, or paſs over the great *Trochanter*, cauſe Bruiſes by Falls on this Part to be attended with great Pain.

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† Γλουτὸς, Rotator natis, malum granatum teſticulorum.
‡ Rotator minor.

Pain and Weakneſs of the Limb, which generally remain long.

The Body of the *Os femoris* is convex on the Fore-part, and made hollow behind, by the Action of the Muſcles that move it and the Leg, and for the Conveniency of Sitting, without bearing too much on theſe Muſcles; and probably the Weight of the Legs depending from the Thighs in that Poſture, contributes to this Curvature.——The Fore-part of the Thigh-bone is a little flatted above by the Beginning of the *Cruræus* Muſcle, as it is alſo below by the ſame Muſcle and the *Rectus*.——Its external Surface is likewiſe made flat below by the *Vaſtus externus*, where it is ſeparated from the former by an obtuſe Ridge.——The *Vaſtus internus* depreſſes a little the lower Part of the internal Surface.—The poſterior concave Surface has a Ridge riſing in its Middle, commony called *Linea aſpera*, into which the *Triceps* is nſerted, and the ſhort Head of the *Biceps flexr tibiæ* riſes from it.——At the upper Part of t the medullary Veſſels enter by a ſmall Hole hat runs obliquely upwards.——A little above which there is a rough *Foſſa* or two, where the Tendon of the *Glutæus maximus* is fixed.——The lower End of the *Linea aſpera* divides into wo, which deſcend toward each Side.——The wo *vaſti* Muſcles have Part of their Origin from theſe Ridges; and the long Tendon of ne *Triceps* is fixed to the internal, by means f Part of the *Faſcia aponeurotica* of the Thigh. ——Near the Beginning of the internal Ridge, here is a Diſcontinuation of the Ridge, where the crural Artery paſſes through the *Aponeuroſis* ——Between theſe two rough Lines, the Bon is made flat by the large Blood-veſſels an Nerves which paſs upon it; and near the En of each of theſe Ridges, a ſmall ſmooth Protuberance may often be remarked, where the tw Heads of the external *Gaſtrocnemius* Muſcle tak their Riſe, and where ſeſamoid Bones are ſometimes found (*a*); and from the Fore-part of th internal Tubercle, a ſtrong Ligament is extended to the Inſide of the *Tibia.*

The lower End of the *Os femoris* is large than any other Part of it, and is formed int a great Protuberance on each Side, called it *Condyles;* between which a conſiderable Cavit is found, eſpecially at the Back-part, in whic the crural Veſſels and Nerves ly immerſed i Fat.——The internal Condyle is longer tha the external, which muſt happen from th oblique Poſition of this Bone, to give leſs Obliquity to the Leg.——Each of theſe Proceſſes ſeems to be divided in its plain ſmoot Surface. The Mark of Diviſion on the external is a Notch, and on the internal a ſmall Protuberance. The Fore-part of this Diviſion, o which the *Rotula* moves, is formed like a Pulley, the external Side of which is higheſt.—— Behind, there are two oblong large Heads whoſe greateſt Extent is backwards, for th Motion of the *Tibia*; and from the rough Cavity between them, but near to the Baſe of th internal Condyle, the ſtrong Ligament commonly called the *croſs* one, has its Riſe.——

littl

(*a*) *Veſal.* Lib. 1. cap. 28. & 30.

little above which a rough Protuberance gives Inſertion to the Tendon of the *Triceps.*——The Condyles, both on the Outer and Inner Side of the Knee, are made flat by the Muſcles paſſing along them.—On the Back-part of the internal, a ſlight Depreſſion is made by the Tendons of the *Gracilis* and *Sartorius*; and on the external ſuch another is formed by the *Biceps flexor cruris*; behind which a deep *Foſſa* is to be obſerved, where the *Poplitæus* Muſcle has its Origin.——From a Tubercle immediately before this Cavity, a ſtrong round Ligament goes out to the upper Part of the *Fibula.*——Round this lower End of the Thigh-bone, large Holes are found, into which the Ligaments for the Security of the Joint are fixed, and Blood-veſſels paſs to the internal Subſtance of the Bone.

All the Proceſſes of the *Femur* are cartilaginous in new-born Children, and afterwards become ſmall *Apophyſes*, with large *Epiphyſes.*

The Thigh-bone is articulated above with the *Acetabulum* of the *Oſſa innominata*, which affords its round Head a ſecure and extenſive Play, and therefore can be moved to every Side; but is reſtrained in its Motion outwards, by the high Brims of the Cavity, and by the *round* Ligament; for otherwiſe the Head of the Bone would have been frequently thruſt out at the Breach of the Brims on the Inſide, which allows the Thigh to move conſiderably inwards.—— The Body of this Bone enjoys little or no rotatory Motion, though the Head moſt commonly moves rounds its own

Axis;

Axis; becauſe the oblique Progreſs of the Neck and Head from the Bone is ſuch, that the rotatory Motion of the Head can only bring the Body of the Bone forwards and backwards: Nor is this Head, as in the Arm, ever capable of being brought to a ſtreight Direction with its Body; ſo far however as the Head can move within the Cavity backwards and forwards, the reſt of the Bone may have a partial Rotation.——The *Os femoris* is articulated below to the *Tibia* and *Rotula* in the Manner afterwards to be deſcribed.

The Nearneſs of the ſmall Neck to the round Head of the Thigh-bone, and its upper End being covered with very thick Muſcles, make greater Difficulty in diſtinguiſhing between a Luxation and Fracture here, than in any other Part of the Body.

The *LEG* * is compoſed, according to the common Account, of two Bones, *Tibia* and *Fibula,* though it ſeems to have a very good Title to a third, the *Rotula;* which bears a ſtrong Analogy to the *Olecranon* of the *Ulna,* and moves always with the other two.

TIBIA ‡, ſo called from its Reſemblance to an old muſical Pipe or Flute, is the long thick triangular Bone, ſituated at the internal Part of the Leg, and continued in almoſt a ſtreight Line from the Thigh-bone.

The upper End of the *Tibia* is large, bulbous, and ſpongy, and is divided into two Cavities;

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* Κνήμη, Crus, tibia.

‡ Προκνήμιον, ἀντικνήμιον, focile majus, arundo major canna major, canna domeſtica cruris.

Cavities, by a rough irregular Protuberance †, which is hollow at its moſt prominent Part, as well as before and behind. The anterior of the two Ligaments that compoſe the great *croſs* one, is inſerted into the middle Cavity, and the Depreſſion behind receives the poſterior Ligament.——The two broad Cavities at the Sides of this Protuberance are not equal; for the internal is oblong and deep, to receive the internal *Condyle* of the Thigh-bone; while the external is more ſuperficial and rounder, for the external *Condyle.*——In each of thoſe two Cavities of a recent Subject, a ſemilunar Cartilage is placed, which is thick at its convex Edge, and becomes gradually thinner towards the concave or interior Edge.——The Middle of each of theſe Cartilages is broad, and the Ends of them turn narrower and thinner, as they approach the middle Protuberance of the *Tibia.*—— The thick convex Edge of each Cartilage is connected to the capſular and other Ligaments of the Articulation, but ſo near to their Riſe from the *Tibia*, that the Cartilages are not allowed to change Place far; while the narrow Ends of the Cartilages becoming almoſt Ligaments, are fixed at the Inſertion of the ſtrong croſs Ligament into the *Tibia*, and ſeem to have their Subſtance united with it; therefore a circular Hole is left between each Cartilage and the Ligament, in which the moſt prominent convex Part of each Condyle of the Thigh-bone moves.——The Circumference of theſe

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† Διάφυσις, ἐξοχὴ νευροχονδρῶδης, Tuber, Tuberculum.

Cavities is rough and unequal for the firm Connexion of the Ligaments of the Joint.—— Immediately below the Edge at its Back-part, two rough flatted Protuberances ſtand out: Into the internal, the Tendon of the *ſemimembranoſus* Muſcle is inſerted; and a Part of the croſs Ligament is fixed to the external. ——On the Outſide of this laſt Tubercle, a ſmooth ſlightly-hollowed Surface is formed by the Action of the *Poplitæus* Muſcle.

Below the Fore-part of the upper End of the *Tibia*, a conſiderable rough Protuberance † riſes, to which the ſtrong tendinous Ligament of the *Rotula* is fixed.——On the internal Side of this, there is a broad ſcabrous ſlightly-hollowed Surface, to which the internal long Ligament of the Joint, the *Aponeuroſis* of the *Vaſtus internus*, and the Tendons of the *Seminervoſus*, *Gracilis* and *Sartorius*, are fixed.——The loweſt Part of this Surface is therefore the Place where the *Tibia* ought to be ſawed through in an Amputation, ſo as not to have too long and troubleſome a Stump, and, at the ſame time, to preſerve its Motions, by ſaving the proper Muſcles.—— Below the external Edge of the upper End of the *Tibia*, there is a circular flat Surface covered in a recent Subject with Cartilage, for the Articulation of the *Fibula*;——between which and the anterior Knob, there is a rough Hollow from which the *Tibialis anticus*, and *Extenſor digitorum longus*, take their Origin. —— From the ſmooth flat Surface, a

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† Ἀντίκνημιον, anterior Tuber.

Ridge runs obliquely downwards and inwards, to give Riſe to Part of the *Solæus*, *Tibialis poſticus*, and *Flexor digitorum longus*, and Inſertion to the *Aponeuroſis* of the *Semimembranoſus* which covers the *Poplitæus*, and to ſome of the external Fibres of this laſt named Muſcle.——At the Inſide of this Ridge, an oblique plain Surface is left, where the greateſt Part of the *Muſculus Poplitæus* is inſerted.——The remaining Body of the *Tibia* is triangular.——The anterior Angle is very ſharp, and is commonly called the *Spine* or *Shin* ‡. This Ridge is not ſtreight; but turns firſt inwards, then outwards, and laſtly inwards again.——The plain internal Side is ſmooth and equal, being little ſubjected to the Actions of Muſcles; but the external Side is hollowed above by the *Tibialis anticus*, and below by the *Extenſor digitorum longus* and *Extenſor pollicis longus*.——The two Angles behind theſe Sides are rounded by the Action of the Muſcles;——the poſterior Side comprehended between them, is not ſo broad as thoſe already mentioned, but is more oblique and flatted by the Action of the *Tibialis poſticus* and *Flexor digitorum longus*.——Some Way above the Middle of the Bone, the internal Angle terminates, and the Bone is made round by the Preſſure of the *Muſculus ſolæus*.——Near to this, the Paſſage of the medullary Veſſels is ſeen ſlanting obliquely downwards.

The lower End of the *Tibia* is made hollow, but ſo as a ſmall Protuberance riſes in the

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‡ Ἄκανθα, Spina, crea, linea prima tibiæ, angulus acutus,

Middle.——The internal Side of this Cavity, which is ſmooth, and, in a recent Subject, is covered with Cartilage, is produced into a conſiderable Proceſs, commonly named *Malleolus internus* †; the Point of which is divided by a Notch, and from it Ligaments are ſent out to the Foot.——We ought to obſerve here, that this internal *Malleolus* is ſituated more forwards than the internal Condyle of the upper End of this Bone; which is neceſſary to be remembered in reducing a Fracture of the Leg (*a*).——The external Side of this End of the *Tibia* has a rough irregular ſemilunar Cavity formed in it, for receiving the lower End of the *Fibula*.——The poſterior Side has two lateral Grooves, and a ſmall middle Protuberance. In the internal Depreſſion, the Tendons of the *Muſculus tibialis poſticus* and *Flexor digitorum longus* are lodged; and in the external, the Tendon of the *Flexor longus pollicis* plays.——From the middle Protuberance, ligamentous Sheaths go out, for tying down theſe Tendons.

The Articulations and Motions of the *Tibia* ſhall be explained, after all the three Bones of the Leg are deſcribed.

Both the Ends of the *Tibia* are Cartilages at the Birth, and become afterwards *Epiphyſes*.

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† Σφυρὸν, πίσον, Talus, clavicula, clavilla interior, cavilla domeſtica.

(*a*) *Winſlow*, Expoſition Anatomique, des Os ſecs, Sect. 865.

FIBULA * is the ſmall long Bone, placed on the Outſide of the Leg, oppoſite to the external Angle of the *Tibia;* the Shape of it is irregularly triangular.

The Head of the *Fibula* has a ſuperficial circular Cavity formed on its Inſide, which, in a recent Subject, is covered with a Cartilage, but ſo cloſely connected to the *Tibia* by Ligaments, as to allow only a ſmall Motion backwards and forwards.——This Head is protuberant and rough on its Outſide, where a ſtrong round Ligament and the *Muſculus Biceps* are inſerted; and, below the Back-part of its internal Side, a Tubercle may be remarked, that gives Riſe to the ſtrong tendinous Part of the *Solæus* Muſcle.

The Body of this Bone is a little crooked nwards and backwards, which Figure is owng to the Actions of the Muſcles; but is ſtill urther increaſed by Nurſes, who often hold Children careleſly by the Legs.——The ſharpeſt Angle of the *Fibula* is forwards, on each Side of which, the Bone is conſiderably, but unequally depreſſed by the Bellies of the ſeveral Muſcles that riſe from, or act upon it; and, in old People, theſe Muſcles make diſtinct Sinuoſities for themſelves.——The exernal Surface of the *Fibula* is depreſſed obliquey from above downwards and backwards, by he two *Peronæi.*—— Its internal Surface is nequally divided into two narrow longitudinal Planes, by an oblique Ridge extended from the upper Part of the anterior Angle, to join with the lower End of the internal Angle. To this Ridge the Ligament ſtretched between the two Bones of the Leg is connected.——The anterior of the two Planes is very narrow above, where the *Extenſor longus digitorum* and *Extenſor longus pollicis* ariſe from it; but is broader below, where it has the Print of the *Nonus Veſalii*.——The poſterior Plane is broad and hollow, giving Origin to the larger Share of the *Tibialis poſticus*.——The internal Angle of this Bone has a tendinous Membrane fixed to it, from which Fibres of the *Flexor digitorum longus* take their Riſe.——The poſterior Surface of the *Fibula* is the plaineſt and ſmootheſt, but is made flat above by the *Solæus*, and is hollowed below by the *Flexor pollicis longus*.——In the Middle of this Surface the Canal for the medullary Veſſels may be ſeen ſlanting downwards.

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* Παρακνήμιον, Perone, Focile minus, arundo minor, canna minor cruris, ſura, radius.

I have taken particular Notice of the Entry and Direction of the medullary Veſſels of the large Bones of the Extremities (*a*); becauſe, in ſeveral chirurgical Caſes, a Surgeon, who is ignorant of this, may do Miſchief to his Patient. Thus, for Example, if theſe Veſſels are opened very near to their Entry into the Bone, or while they are in the oblique Paſſage through it, an obſtinate Hæmorrhagy may enſue: For the Arteries being connected to the bony Paſſage, Styptics, and other like Corrugators, are vainly applied; compreſſing Inſtruments can do no Service, and Ligatures cannot

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(*a*) *Havers*, Oſteolog. nov. Diſc. 1. p. 59.

ot be employed.——There ſeems to be a par-
icular Deſign in the Contrivance of theſe
anals; thoſe in the *Os humeri*, *Tibia*, and
ibula, running obliquely downwards from
heir external Entry; whereas in the *Radius*,
lna, and *Os femoris*, they ſlant upwards,
hereby the Arteries and Nerves which are
ent into theſe three laſt Bones, muſt ſuffer a
onſiderable Reflexion before they come at
he *Cancelli*. The Reaſon of this Diverſity
ay perhaps be, that the Arteries which are
ſmall within the Bones as to have no ſtrong
ontractile propelling Force in their Coats,
nd where they are not aſſiſted by the Action
f any moving neighbouring Organ, ſhould
ave, at leaſt in their Paſſage through the
one, a favourable Deſcent for their Liquids:
hich, it is evident, they have in the de-
ending oblique Paſſages formed for them in
e firſt Claſs of Bones, to wit, the *Os humeri*,
ibia and *Fibula*, which are generally depend-
g; and they alſo moſt frequently acquire
e like Advantage in the *Radius*, *Ulna*, and
femoris, becauſe the Hand, in the moſt
tural Poſture, is higher than the Elbow;
d when we ſit or lie, the lower End of the
high-bone comes to be at leaſt as high raiſed
the upper. In ſtanding and walking, or
hen the Arms are moved, the Blood muſt in-
eed aſcend as it paſſes through the Bones of
e Fore-arm and Thigh; but the Preſſure of
e Muſcles, then in Action, on the Veſſels,
fore they enter the Bones, is ſufficient to
mpenſate the Diſadvantage of their Courſe.
his Reaſoning ſeems to be ſtill enforced, by

obſerving, that this Paſſage is always neare
the upper than the lower Ends of theſe
Bones.

The lower End of the *Fibula* is extende
into a ſpongy oblong Head, on the Inſide o
which is a convex, irregular, and frequentl
a ſcabrous Surface, that is received by th
external Hollow of the *Tibia*, and ſo firml
joined to it by a very thin intermediate Car
tilage and ſtrong Ligaments, that it ſcarce ca
move.—Below this, the *Fibula* is ſtretched ou
into a coronoid Proceſs, that is ſmooth, covere
with Cartilage on its internal Side, and is the
contiguous to the Outſide of the firſt Bone of th
Foot, the *Aſtragalus*, to ſecure the Articulati
on. This Proceſs, named *Malleolus externu*
being ſituated farther back than the intern
Malleolus, and in an oblique Direction, oblige
us naturally to turn the Fore-part of the Fo
outwards (*a*). At the lower internal Part
this Proceſs, a ſpongy Cavity for mucilagine
Glands may be remarked; from its Point L
gaments are extended to the *Aſtragalus*, C
Calcis, and *Os Naviculare*, Bones of the Foot
and from its Inſide ſhort ſtrong ones go o
to the *Aſtragalus*. On the Back-part of it
Sinuoſity is made by the Tendons of the *P*
ronæi Muſcles.——When the Ligament e
tended over theſe Tendons from the one Si
of the Depreſſion to the other is broke, ſtretc
ed too much, or made weak by a Sprain, t
Tendons frequently ſtart forwards to the Ou
ſide of the *Fibula*.

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(*a*) *Winſlow*, Memoires de l'Acad. des Sciences, 1722.

The Conjunction of the upper End of the
ibula with the *Tibia* is by plain Surfaces tip-
ed with Cartilage, and at its lower End the
artilage ſeems to glue the two Bones together,
ot, however, ſo firmly in young People, but
hat the Motion at the other End of ſuch a
ng *Radius* is very obſervable.——In old Sub-
ects I often ſee the two Bones of the Leg
rown together at their lower Ends.

The principal Uſe of this Bone is to afford
rigin and Inſertion to Muſcles; the Direction
f which may be a little altered on proper Oc-
aſions, by its upper Part ſhuffling backwards
d forwards.——It likewiſe helps to make the
rticulation of the Foot more ſecure and firm.
—The Ends of the *Tibia* and *Fibula* being
rger than their Middle, a Space is here left,
hich is filled up with ſuch another Ligament
I deſcribed extended between the Bones of
e Fore-arm; and which is alſo diſcontinued at
upper Part, where the *Tibialis anticus* imme-
ately adheres to the *Solæus* and *Tibialis poſti-
s*; but every where elſe it gives Origin to
uſcular Fibres *(a)*.

Both the Ends of this Bone are cartilaginous
a ripe Child, and aſſume the Form of *Appen-
ces* before they are united to its Body.

ROTULA * is the ſmall flat Bone ſituated
the Fore-part of the Joint of the Knee.——
Shape reſembles the common Figure of the
eart with its Point downwards.——The ante-
rior

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a) *Weitbrecht*. Syndeſmolog. p. 156.

* Ἐπιμυλὶς, μυλαχρὶς, κόγχος, ἐπιγονατὶς, πλανησίεδρον,
ella, mòla, genu, ſcuti-forme os, cartilaginoſum, diſci-
ne, oculus genu.

rior convex Surface of the *Rotula* is pierced by a great Number of Holes, into which Fibres of the ſtrong Ligament that is ſpread over it enter.——Behind, its Surface is ſmooth, covered with Cartilage, and divided by a middle convex Ridge into two Cavities, of which the external is largeſt; and both are exactly adapted to the Pulley of the *Os femoris*, on which they are placed in the moſt ordinary unſtraining Poſtures of the Leg; but when the Leg is much bended, the *Rotula* deſcends far down on the Condyles; and when the Leg is fully extended, the *Rotula* riſes higher, in its upper Part, than the Pulley of the Thigh-bone.——The plain ſmooth Surface is ſurrounded by a rough prominent Edge, to which the capſular Ligament adheres:—Below, the Point of the Bone is ſcabrous, where the ſtrong tendinous Ligament from the Tubercle of the *Tibia* is fixed.——The upper horizontal Part of this Bone is flatted and unequal, where the Tendons of the Extenſors of the Leg are inſerted.

The Subſtance of the *Rotula* is cellular, with very thin external firm Plates: But then theſe *Cells* are ſo ſmall, and ſuch a Quantity of Bone is employed in their Formation, that ſcarce any Bone of its Bulk is ſo ſtrong. Beſides, it is covered all over with a thick Ligament, (as it was obſerved, that this Sort of Bones generally is) to connect its Subſtance, and is moveable to one Side or other; therefore is ſufficiently ſtrong to reſiſt the ordinary Actions of the large Muſcles that are inſerted into it, or any common external Force applied to it; while a fixed Proceſs, ſuch as the *Olecranon*, would not have been ſufficient to bear the whole Weight of our Bodies, which frequently fall on it, and would have hindered the rotatory Motion of the Leg. Notwithſtanding theſe Precautions to preſerve this Bone from ſuch Injuries, yet I have ſeen a tranſverſe Fracture in it, when, by the Report of the Patient, and of the People about him, and by the Want of Swelling, Diſcolouring, or other Mark of Bruiſe or Contuſion, it was plain the Bone was broken by the violent ſtraining Effort of the Muſcles *(a)*. Though my Patient recovered the Uſe of the Joint of the Knee, yet I think it reaſonable to believe, that this Sort of Fracture is commonly attended with Difficulty of Motion, after the broken Parts of the *Rotula* are reunited, becauſe the callous Matter probably extends itſelf into the Cavity of the Joint, where it either grows to ſome of the Parts, or makes ſuch an Inequality on the Surface of this Bone, as does not allow it to perform the neceſſary Motions on the Condyles of the *Femur (b)*.

At the ordinary Time of Birth, the *Rotula* is entirely cartilaginous, and ſcarcely aſſumes a bony Nature ſo ſoon as moſt *Epiphyſes* do.

The Parts which conſtitute the Joint of the Knee being now deſcribed, let us examine what are its Motions, and how performed.——The two principal Motions are Flexion and Extenſion——In the former of theſe, the Leg may be brought to a very acute Angle with the Thigh, by the Condyles of the Thigh-bones being

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(*a*) See *Ruyſch.* Obſerv. Anat. Chirurg. Obſ. 3.

(*b*) *Parè*, Liv. 15. cap. 22.

being round and made ſmooth far backwards. In performing this, the *Rotula* is pulled down by the *Tibia*.—When the Leg is to be extended, the *Rotula* is drawn upwards, and conſequently the *Tibia* forwards, by the *Extenſor* Muſcles; which, by Means of the protuberant Joint, and of this thick Bone with its Ligament, have in effect the Chord, with which they act, fixed to the *Tibia* at a conſiderable Angle, therefore act with Advantage; but are reſtrained from pulling the Leg farther than to a ſtreight Line with the Thigh, by the poſterior Part of the *croſs* Ligament, that the Body might be ſupported by a firm perpendicular Column: For at this Time the Thigh and Leg are as little moveable in a rotatory Way, or to either Side, as if they were one continued Bone.——But when the Joint is a little bended, the *Rotula* is not tightly braced, and the poſterior Ligament is relaxed; therefore this Bone may be moved a little to either Side, or with a ſmall Rotation in the ſuperficial Cavities of the *Tibia*; which is done by the Motion of the external Cavity backwards and forwards, the internal ſerving as a ſort of Axis *(a)*. Seeing then one Part of the *croſs* Ligament is ſituated perpendicularly, and the poſterior Part is ſtretched obliquely from the internal Condyle of the Thigh outwards, that poſterior Part of the *croſs* Ligament prevents the Leg's being turned at all inwards; but it could not hinder it from turning outwards almoſt round, was not that Motion confined by the lateral Ligaments

of

(*a*) *Winſlow*, Expoſition Anatomique du corps humain, traitè des Os ſecs, § 976.

of this Joint, which can yield little. This Rotation of the Leg outwards, is of good Advantage to us in croſſing our Legs, and turning our Feet outwards, on ſeveral neceſſary Occaſions; tho' it is altogether fit this Motion ſhould not be very large, to prevent frequent Luxations here. ——While all theſe Motions are performing, the Part of the *Tibia* that moves immediately on the Condyles is only ſo much as is within the cartilaginous Rings, which, by the Thickneſs on their Outſides, make the Cavities of the *Tibia* more horizontal, by raiſing their external Side where the Surface of the *Tibia* ſlants downwards. By this Means the Motions of this Joint are more equal and ſteady than otherwiſe they would have been. The Cartilages being capable of changing a little their Situation, are fit for doing this good Office in the different Motions and Poſtures of the Member, and likewiſe contribute to make the Motions larger and quicker.

On Account of the very large Surface of the Bones forming the Joint of the Knee, and the many ſtrong Ligaments connecting them, Luxations ſeldom happen here. But theſe very Ligaments, the *Aponeuroſes* paſſing over this Joint, the Quantity of Fat and mucaginous Glands neceſſary for lubricating it, make it more ſubject to *White-ſwellings*, Dropſies, and ſuch other Diſorders, than any other Joint of the Body.

The *FOOT* is divided, as well as the Hand, into three Parts, *viz.* *Tarſus*, *Metatarſus*, and *Toes*: In the Deſcription of which, the ſeveral Surfaces ſhall be named, according to their natural

tural Situation, *viz.* the *Broad* of the Foot, ſhall be called ſuperior; the Sole, inferior; the Side on which the Great-toe is, internal; that where the Little-toe is, external.

The *Tarſus* * conſiſts of ſeven ſpongy Bones; to wit, the *Aſtragalus, Os calcis, Naviculare, Cuboides, Cuneiforme externum, Cuneiforme medium,* and *Cuneiforme internum.*

The *Aſtragalus* is the uppermoſt of theſe Bones.——The *Os calcis* is below the *Aſtragalus*, and is conſiderably prominent backwards beyond the other Bones of the *Tarſus*, to form the Heel.—The *Os naviculare* is in the Middle of the internal Side of the *Tarſus.*——The *Os cuboides* is the moſt external of the Row of four Bones at the Fore-part of the *Tarſus.*——The *Os cuneiforme externum* is placed at the Inſide of the *Cuboid.*——The *Cuneiforme medium* is between the *external* and *internal cuneiform* Bones, and the *internal Cuneiform* is put at the internal Side of the Foot.

That the Deſcription of theſe Bones may not be immoderately ſwelled with Repetition, I deſire, once for all, to obſerve, That where-ever a Ridge is mentioned, without a particular Uſe aſſigned, a Ligament is underſtood to be fixed to it; or where a ſpongy rough Cavity, Depreſſion or *Foſſa* is remarked, without naming its Uſe, a Ligament is inſerted, and mucilaginous Glands are lodged: For ſuch will occur in the Detail of each of theſe Bones.

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* Raſſetta.

The upper Part of the *Aſtragalus* † is formed into a large ſmooth Head ‡, which is ſlightly hollowed in the Middle; and therefore reſembles a ſuperficial Pulley, by which it is fitted to the lower End of the *Tibia*.——The internal Side of this Head is flat and ſmooth, to play on the internal *Malleolus*.——The external Side has alſo ſuch a Surface, but larger, for its Articulation with the external *Malleolus*.——Round the Baſe of this Head there is a rough *Foſſa*; and, immediately before the Head, as alſo below its internal ſmooth Surface, we find a conſiderable rough Cavity.

The lower Surface of the *Aſtragalus* is divided by an irregular deep rough *Foſſa*; which at its internal End is narrow, but gradually widens, as it ſtretches obliquely outwards and forwards.——The ſmooth Surface, covered with Cartilage, behind this *Foſſa*, is large, oblong, extended in the ſame oblique Situation with the *Foſſa*, and concave, for its Conjunction with the *Os calcis*.—The Back-part of the Edge of this Cavity is produced into two ſharp-pointed rough Proceſſes, between which is a Depreſſion made by the Tendon of the *Flexor pollicis longus*.——The lower Surface before the *Foſſa* is convex, and compoſed of three diſtinct ſmooth Planes. The long one behind, and the exterior or ſhorteſt, are articulated with the Heel-bone; while the internal, which is the moſt convex of the three, reſts and moves upon a cartilaginous Ligament,

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† Ἄϛριος, Talus, baliſtæ os, malleolus, chaib, quatrio, Os teſſaræ, claviculæ, nuciforme.

‡ Τετρώρος.

that is continued from the *Calcaneum* to the *Os ſcaphoides*. Without which Ligament, the *Aſtragalus* could not be ſuſtained, but would be preſſed out of its Place by the great Weight it ſupports, and the other Bones of the *Tarſus* would be ſeparated. Nor would a Bone be fit here, becauſe it muſt have been thicker than could conveniently be allowed; otherwiſe it would break, and would not prove ſuch an eaſy bending Baſe, to leſſen the Shock which is given to the Body in leaping, running, *&c.*

The Fore-part of this Bone is formed into a convex oblong ſmooth Head, called by ſome its Proceſs, which is received by the *Os naviculare*. ——Round the Root of this Head, eſpecially on the upper Surface, a rough *Foſſa* may be remarked.

The *Aſtragalus* is articulated above to the *Tibia* and *Fibula*, which together form one Cavity. Though, in this Articulation, the Bones have Prominencies and Cavities ſo ſmall, as might allow Motions in all Directions, yet the Flexion and Extenſion are the moſt conſiderable, the other Motions being confined by the *Malleoli*, and by the ſtrong Ligaments which go out from the Points of theſe Proceſſes to the *Aſtragalus* and *Os calcis*.—When the Foot is bended, ſo far as it is commonly when we ſtand, no lateral or rotatory Motion is allowed in this Joint; for then the Head of the *Aſtragalus* is ſunk deep between the *Malleoli*, and the Ligaments are tenſe; but when the Foot is extended, the *Aſtragalus* can move a little to either Side, and with a ſmall Rotation. By this Contrivance the Foot is firm, when the

Weight of the Body is to be ſupported on it; and when a Foot is raiſed, we are at Liberty to direct it more exactly to the Place we intend next to ſtep upon.——The *Aſtragalus* is joined, below, to the *Os calcis;* and before, to the *Os naviculare*, in the Manner to be explained, when theſe Bones are deſcribed.

A conſiderable Share of this Bone is oſſified in a new-born Infant.

Calcaneum * is the largeſt Bone of the ſeven.——Behind, it is formed into a large Knob, commonly called the *Heel:* The Surface of which is rough behind, where the *Tendo Achillis* is inſerted into it; and above, it is hollow and ſpongy. Farther forwards, on the upper Surface of the *Calcaneum*, there is an irregular oblong ſmooth Convexity, adapted to the Concavity at the Back-part of the *Aſtragalus:* And beyond this a narrow *Foſſa* is ſeen, which divides it from two ſmall concave ſmooth Surfaces, that are joined to the Fore-part of the *Aſtragalus.*——Behind the poſterior of theſe ſmooth Surfaces, which is the largeſt, a ſmall Sinuoſity is made by the Tendon of the *Flexor digitorum longus*; at the Fore-part of which a ſmall rough Protuberance appears, that gives Riſe to the *Muſculus extenſor digitorum brevis.*

The external Side of this Bone is flat, with a ſuperficial *Foſſa* running horizontally, in which the Tendon of the *Muſculus peronæus longus* is lodged.——The internal Side of the Heel-bone is hollowed, for lodging the Origin of the *Maſſa carnea Jac. Sylvii*, and for the ſafe Paſſage of

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* Os calcis, πτέρνα, calcar pedis.

Tendons, Nerves, and Arteries.——Under the Side of the internal ſmooth Concavity, a particular Groove is made by the Tendon of the *Flexor pollicis longus;* and from the thin Protuberance on this internal Side, the cartilaginous Ligament that ſupports the *Aſtragalus*, goes out to the *Os naviculare*; on which Ligament, and on the Edge of this Bone to which it is fixed, the Groove is formed for the Tendon of the *Flexor digitorum profundus*.

The lower Surface of this Bone is preſſed flat at the Back-part, by the Weight of our Bodies; and immediately before this Plane, there are two Tubercles, from the internal of which the *Muſculus abductor pollicis, Flexor digitorum ſublimis*, as alſo part of the *Aponeuroſis plantaris*, and of the *Abductor minimi digiti*, have their Origin; and the other Part of the *Abductor minimi digiti* and *Aponeuroſis plantaris* riſes from the external.——Before theſe Protuberances this Bone is concave, for lodging the Flexor-muſcles; and at its Fore-part we may obſerve a rough Depreſſion, from which, and a Tubercle behind it, the Ligament goes out that prevents this Bone to be ſeparated from the *Os Cuboides*.

The Fore-part of the *Os calcis* is formed into an oblong Pulley-like ſmooth Surface, which is circular at its upper external End, but is pointed below. This ſmooth Surface is fitted to the *Os cuboides*.

Though the Surfaces by which the *Aſtragalus* and *Os Calcis* are articulated, ſeem fit enough for Motion; yet the very ſtrong Ligaments by which theſe Bones are connected, prevent it, and render this principal Part of our Baſe, which reſts on the Ground, *to wit*, the *Os calcis*, firm.

A large Share of the Heel-bone is oſſified at the ordinary Time of Birth, and the large Knob appears afterwards in Form of an *Epiphyſe*.

Os naviculare ‡, is ſomewhat circular.—— It is formed into an oblong Concavity behind for receiving the anterior Head of the *Aſtragalus*.—— On the upper Surface there is a rough *Foſſa*.——Below, the *Os naviculare* is very unequal and rough; but hollow for the Safety of the Muſcles.——On its Inſide a large Knob riſes out, from which the *Abductor pollicis* takes in Part its Origin, and the Tendon of the *Tibialis poſticus* is inſerted into it: And to it two remarkable Ligaments are fixed; the firſt is the ſtrong one, formerly mentioned, which ſupports the *Aſtragalus*; the ſecond is ſtretched from this Bone obliquely croſs the Foot, to the metatarſal Bones of the middle Toe, and of the Toe next to the little one.——On the Outſide of the *Os naviculare* there is a ſemicircular ſmooth Surface, where it is joined to the *Os cuboides*.——The Fore-part of this Bone is all covered with Cartilage, and is divided into three ſmooth Planes, fitted to the three *Oſſa cuneiformia*.

The *Os naviculare* and *Aſtragalus* are joined as a Ball and Socket, and the *Naviculare* moves in all Directions in turning the Toes inwards,

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‡ Σκαφοειδὴς, Os cymbæ.

wards, or in raiſing or depreſſing either Side of the Foot, though the Motions are greatly reſtrained by the Ligaments which connect this to the other Bones of the *Tarſus*.——A Weakneſs of theſe Ligaments cauſes ſometimes an unnatural Turn of the Fore-part of the Foot inwards.

The *Os naviculare* is wholly cartilaginous in a new-born Infant.

OS CUBOIDES [‡] is a very irregular Cube.——Behind, it is formed into an oblong unequal Concavity, adapted to the Fore-part of the *Os calcis*.——On its internal Side, there is a ſmall ſemicircular ſmooth Cavity, to join the *Os naviculare*; immediately before which, an oblong ſmooth Plane is made by the *Os cuneiforme externum*.——Below this, the Bone is hollow and rough.——On the internal Side of the lower Surface, a round Protuberance and *Foſſa* are found, where the *Muſculus adductor pollicis* has its Origin. On the external Side of this ſame Surface, there is a round Knob, covered with Cartilage; immediately before which, a ſmooth *Foſſa* may be obſerved, in which the Tendon of the *Peronæus primus* runs obliquely croſs the Foot; and on the Knob, the thin flat Cartilage proper to this Muſcle plays; in Place of which ſometimes a Bone is found:——More externally than the Knob, a rough Hollow is made, for the ſtrong Ligaments ſtretched betwixt this Bone and the *Os calcis*.——Before, ſore, the Surface of the *Os cuboides* is flat, ſmooth, and ſlightly divided into two Planes, for ſuſtaining the *Os metatarſi* of the little Toe, and of the Toe next to it.

[‡] Πολύμορφον, cubiforme, quadratum, grandinoſum, varium, teſſaræ, multiforme.

The Form of the Back-part of the *Os cuboides*, and the Ligaments connecting the Joint there with the *Os calcis*, both concur in allowing little Motion in this Part.

The Oſſification of this Bone is ſcarcely begun at the Birth.

Os cuneiforme externum *, if we regard its Situation or *medium* by its Bulk, is much of the Shape of a Wedge, being broad and flat above, with long Sides running obliquely downwards, and terminating in a ſharp Edge. ——The upper Surface of this Bone is an oblong Square.——The one behind is nearly a Triangle, but not compleat at the inferior Angle, and is joined to the *Os naviculare.*——The external Side is an oblong Square divided as it were by a Diagonal; the upper Half of it is ſmooth, for its Conjunction with the *Os cuboides:* The other is a ſcabrous Hollow, and in its ſuperior anterior Angle a ſmall ſmooth Impreſſion is made by the *Os metatarſi* of the Toe next to the little one.——The internal Side of this Bone is alſo quadrangular, with the Fore-part of its Edge made flat and ſmooth by the *Os metatarſi* of the Toe next to the great one, and the Back-part is alſo flat and ſmooth where the *Os cuneiforme medium* is contiguous to it.——The Fore-part of this

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* Chalcoideum externum.

Bone is an oblong Triangle, for ſuſtaining th *Os metatarſi* of the middle Toe.

Os cuneiforme medium, or *minimum*, is ſtil more exactly the Shape of a Wedge than th former.——Its upper Part is Square;—— it internal Side has a flat ſmooth Surface abov and behind, for its Conjunction with the following Bone; with a ſmall rough *Foſſa* below and a conſiderable Share of it is rough an hollow.——The external Side is ſmooth an a little hollowed, where it is contiguous to th laſt deſcribed Bone.——Behind, this Bone i triangular, where it is articulated with th *Os naviculare;* and it is alſo triangular at it Fore-part, where it is contiguous to the *O metatarſi* of the Toe next to the great one.

Os cuneiforme maximum, or *internum*, differs from the two former in its Situation, whic is more oblique than their's.——Beſides, it broad thick Part is placed below, and th ſmall thin Point is above and outwards; whil its under broad Surface is concave, for allowing a ſafe Paſſage to the Flexors of the grea Toe.—The Surface of this *Os cuneiforme* behind, where it is joined to the *Os naviculare* is hollow, ſmooth, and of a circular Figur below, but pointed above.——The externa Side conſiſts of two ſmooth and flat Surface whoſe Direction is nearly at right Angle with each other. With the poſterior, tha runs obliquely from below forwards and upwards, the *Os cuneiforme minimum* is joined and with the anterior, whoſe Direction is longitudinal, the *Os metatarſi* of the Toe nex to the great one is connected.——The Fore part of this Bone is ſemilunar, but flat and ſmooth, for ſuſtaining the *Os metatarſi* of the great Toe.——The internal Side is ſcabrous, with two remarkable Tubercles below, from which the *Muſculus abductor pollicis* riſes; and the *Tibialis anticus* is inſerted into its upper Part.

The three cuneiform Bones are all ſo ſecured by Ligaments, that very little Motion is allowed in any of them, and they are cartilaginous in a *Fœtus* of nine Months.

Theſe ſeven Bones of the *Tarſus*, when joined, are convex above, and leave a Concavity below, for lodging ſafely the ſeveral Muſcles, Tendons, and Veſſels that lie in the Sole of the Foot.——In the recent Subject, their upper and lower Surfaces are covered with ſtrong Ligaments, which adhere firmly to them, and all the Bones are ſo tightly connected by theſe and the other Ligaments, which are fixed to the rough Ridges and *Foſſæ* mentioned in the preceeding Deſcription of the particular Bones, that, notwithſtanding the many Surfaces covered with Cartilage, ſome of which are of the Form of the very moveable Articulations, no more Motion is here allowed, than only to prevent too great a Shock of the Fabric of the Body in walking, leaping, *&c.* by falling on too ſolid a Baſe; which, if it was one continued Bone, would likewiſe be much more liable to be broken; and, in order to make our Foot accommodate itſelf to the Surfaces we tread on, by becoming more or leſs hollow, or by raiſing or depreſſing either Side of it, as might be judged by what was ſaid of the particular Bones.

Sprains here occaſion, as in the Wriſt great Pain and obſtinate Tumors, which to often cauſe carious Bones.

METATARSUS * is compoſed of fiv Bones, which, in their general Characters, agree with the metacarpal Bones; but may b diſtinguiſhed from them by the followin Marks: 1. They are longer, thicker, an ſtronger. 2. Their anterior round Ends ar not ſo broad, and are leſs in Proportion t their Baſes. 3. Their Bodies are ſharper above and flatter on the Sides, with their inferio Ridge inclined more to the Outſide. 4. Th Tubercles at the lower Parts of the round Hea are larger.

The firſt or internal metatarſal Bone is eaſily diſtinguiſhed from the reſt by its Thickneſs.——The one next to it is the longeſt, an with its ſharp Edge almoſt perpendicular.—— The others are ſhorter and more oblique, a their Situation is more external. Which general Remarks, with the Deſcription I am now to give of each, may teach us to diſtinguiſh them from each other.

Os metatarſi pollicis is by far the thickeſt an ſtrongeſt, as having much the greateſt Weigh to ſuſtain. Its Baſe is oblong, irregularl concave, and of a ſemilunar Figure, to be adapted to the *Os cuneiforme maximum.*—— The inferior Edge of this Baſe is a little prominent and rough, where the Tendon of th *Peronæus primus* Muſcle is inſerted.——O it its Outſide an oblique circular Depreſſion is made by the ſecond metatarſal Bone.——Its round Head has generally on its Fore-part a middle Ridge, and two oblong Cavities, for the *Oſſa ſeſamoidea;* and on the external Side a Depreſſion is made by the following Bone.

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* Στῆθος, πεδίον, Planta, planum, veſtigium, ſolium, pectus, præcordium, pectuſculum.

Os metatarſi of the ſecond Toe, is the longeſt of the five, with a triangular Baſe ſupported by the *Os cuneiforme medium*, and the external Side produced into a Proceſs; the End of which is an oblique ſmooth Plane, joined to the *Os cuneiforme externum.*——Near the internal Edge of the Baſe, this Bone has two ſmall Depreſſions, made by the *Os cuneiforme maximum*, between which is a rough Cavity. ——Farther forwards we may obſerve a ſmooth Protuberance, which is joined to the foregoing Bone.——On the Outſide of the Baſe are two oblong ſmooth Surfaces, for its Articulation with the following Bone; the ſuperior ſmooth Surface being extended longitudinally, and the inferior perpendicularly; between which there is a rough *Foſſa.*

Os metatarſi of the middle Toe, is the ſecond in Length.——Its Baſe, ſupported by the *Os cuneiforme externum*, is triangular, but ſlanting outwards, where it ends in a ſharp-pointed little Proceſs; and the Angle below is not compleated.

The internal Side of this Baſe is adapted to the preceeding Bone; and the external Side has alſo two ſmooth Surfaces covered with Cartilage, but of a different Figure; for the upper one is concave, and, being round behind, turns ſmaller as it advances forwards;

and

and the lower Surface is little, ſmooth, convex, and very near the Edge of the Baſe.

Os metatarſi of the fourth Toe, is near as long as the former, with a triangular ſlanting Baſe joined to the *Os cuboides*, and made round at its external Angle, having one hollow ſmooth Surface on the Outſide, where it is preſſed upon by the following Bone, and two on the internal Side, correſponding to the former Bone; behind which is a long narrow Surface impreſſed by the *Os cuneiforme externum*.

Os metatarſi of the little Toe, is the ſhorteſt, ſituated with its two flat Sides above and below, and with the Ridges laterally. — The Baſe of it, Part of which reſts on the *Os cuboides*, is very large, tuberous, and produced into a long-pointed Proceſs externally, where Part of the *Abductor minimi digiti* is fixed; and into its upper Part the *Peronæus ſecundus* is inſerted.——Its Inſide has a flat conoidal Surface, where it is contiguous to the preceeding Bone.

When we ſtand, the fore Ends of theſe metatarſal Bones, and the *Os calcis*, are our only Supporters; and therefore it is neceſſary they ſhould be ſtrong, and ſhould have a confined Motion.

The Bones of the *TOES* are much a-kin to thoſe of the Thumb and Fingers: Particularly the two of the great Toe are preciſely formed as the two laſt of the Thumb; only their Poſition, in reſpect of the other Toes, is not oblique; and they are proportionally much ſtronger, becauſe they are ſubjected to a greater Force; for they ſuſtain the Force with which our Bodies are puſhed forwards by the Foot behind at every Step we make; and on them principally the Weight of the Body is ſupported, when we are raiſed on our Tiptoes.

The three Bones in each of the other four Toes, compared to thoſe of the Fingers, differ from them in theſe Particulars.——They are leſs, and ſmaller in Proportion to their Lengths: —— Their Baſes are much larger than their anterior Ends:——Their Bodies are more narrow above and below, and flatter on the Sides.——The firſt *Phalanx* is proportionally much longer than the Bones of the ſecond and third, which are very ſhort.

Of the four, the Toe next to the great one, has the largeſt Bones in all Dimenſions; and more externally the Toes are leſs.——The little Toe, and frequently that next to it, have the ſecond and third Bones intimately united into one; which may be owing to their little Motion, and the great Preſſure they are ſubjected to.

The Toes are of good Uſe to us in walking; for, when the Sole is raiſed, they bring our Body, with its Center of Gravity, perpendicular to the advanced Foot.

The Bones of the *Metatarſus* and Toes, are in the ſame Condition in Children as thoſe of the *Metacarpus* and Fingers.

The only Bones now remaining to complete the Deſcription of the Skeleton, are the ſmall ones, which are found at the Joints of the

Fingers and Toes, and in ſome other Parts, called,

OSSA SESAMOIDEA, which are of very different Figures and Sizes, though they are generally ſaid to reſemble the Seed of the *Seſamum.*——They ſeem to me nothing elſe than the Ligaments of the Articulations or the firm Tendons of ſtrong Muſcles, or both, become bony, by the Compreſſion which they ſuffer. Thus the *ſeſamoid* Bones at the Beginning of the *Gaſtrocnemii* Muſcles, are evidently compoſed of the tendinous Fibres only.——Theſe, at the firſt Joint of the great Toe, are as plainly the ſame continued Subſtance with the Ligaments and the Tendons of the *Abductor*, *Flexor brevis*, and *Adductor.*——That which is ſometimes double at the ſecond Joint of that Toe, is Part of the capſular Ligament; and if we enumerate the other *ſeſamoid* Bones that are at any time found, we may obſerve all of them formed in this Manner.——Their Number, Figure, Situation, and Magnitude, are ſo uncertain, that it were in vain to inſiſt on the Differences of each; and therefore I ſhall only in general remark,

1. That where-ever the Tendons and Ligaments are firmeſt, the Actions of the Muſcles ſtrongeſt, and the Compreſſion greateſt, there ſuch Bones are moſt commonly found.

2. That, *cæteris paribus*, the older the Subject is in which they are ſought, their Number is greater, and their Size is larger.

3. The more Labour any Perſon is inured to, he has, *cæteris paribus*, the moſt numerous and largeſt *Oſſa ſeſamoidea*.

However, as the two at the firſt Joint of the great Toe are much larger than any other, are early formed, and are ſeldom wanting in an Adult, we may judge, that beſides the more forcible Cauſe of their Formation, there ſhould alſo be ſome particular Advantage neceſſary at this Place, rather than elſewhere, which may poſſibly be, to allow the *Flexor* Muſcles to ſend their Tendons along this Joint, ſecure from Compreſſion in the Hollow between the two oblong ſeſamoid Bones; while, by removing theſe Tendons from the Center of Motion, and giving them the Advantage of an Angle at their Inſertion, the Force of the Muſcles is increaſed, and therefore the great ſuperincumbent Weight of our Body in Progreſſion is more eaſily raiſed.

APPENDIX.

Of the Marks of a FEMALE SKELETON.

TO finiſh the Deſcription of the Bones, is generally to conclude the *Oſteology*; but, that no Part of the Subject may be left untouched, I think it neceſſary to ſubjoin the diſtinguiſhing Marks of the Male and Female Skeletons; and have choſen to illuſtrate them principally in the latter; becauſe Women having a more delicate Conſtitution, and affording Lodging and Nouriſhment to their tender *Fœtuſes*, till they have ſufficient Strength and Firmneſs to bear the Injuries of the Atmoſphere, and Contact of other more ſolid Subſtances, their Bones are frequently incomplete, and always of a Make in ſome Parts of the Body different from thoſe of the robuſt Male; which agree to the Deſcription already given, unleſs where the proper Specialities of the Female were particularly remarked; which could not be done in all Places where they occur, without perplexing the Order of this Treatiſe: Therefore I choſe rather to ſum them up here by Way of *Appendix*.

The Cauſes of the following Specialities of the Female Bones, may be reduced to theſe three. 1. A weak lax Conſtitution. 2. A ſedentary unactive Life, increaſing that Conſtitution. 3. A proper Frame for being Mothers.

The Bones of Women are ſmaller in Proportion to their Length than thoſe of Men; becauſe the Force of their Muſcles is not ſo great, nor is ſuch ſtrong external Force applied to them to prevent their ſtretching out in Length.

The Depreſſions, Ridges, ſcabrous Surfaces, and other Inequalities made by the Muſcles, are not ſo conſpicuous in them; becauſe their Muſcles are neither ſo thick nor ſtrong, nor ſo much employed, to make ſo ſtrong Prints on their Bones.

Their *Os frontis* is more frequently divided by a Continuation of the *ſagittal* Suture, which depends on the firſt and ſecond general Cauſes aſſigned above, for the Specialities in their Bones; as will appear after reflecting on the Account given formerly of the middle internal Spine of this Bone.

Their *Clavicles* are leſs crooked; becauſe their Arms have been leſs forcibly pulled forwards, which in our *European* Women, eſpecially thoſe of Diſtinction, is more hindered by their Garb.

Their *Sternum* is more raiſed by long Cartilages below, that the *Thorax* might be there widened in ſome Proportion to what it is ſhortened by the Preſſure upon the *Diaphragm*, when they are with Child.

The Defect of Bone, or the Hole in the Middle of the *Sternum*, is ofteneſt found in them, to allow the Paſſage of the mammary

Veſſels, ſay ſome; but, in my Opinion, this is owing to a lax Conſtitution, by which the Oſſification is not ſo ſoon completed as in Men, where the Action of the Solids is vigorous, and the Circulation of the Fluids is briſk; for a much ſmaller Hole might have ſerved this Purpoſe; and the Branches of the internal mammary Veſſels which are ſent to the external Parts of the *Thorax*, do not paſs here, but between the Cartilages of the Ribs, before theſe are joined to the *Sternum*.

The *Cartilago Xiphoides*, is oftner bifurcated in Women than Men, for the Reaſon aſſigned in the preceeding Paragraph, *viz.* a leſs forcible Power of Oſſification.

The ſuperior Cartilages of the Ribs ſooner oſſify, to ſupport the Weight of the *mammæ*.

The middle Cartilages are more flat and broad by the Weight of the Breaſts.

The inferior Cartilages are longer, for enlarging the Cheſt.

Weak Women who have born many Children when young, often have the *Vertebræ* of their Back bended forwards, and their *Sternum* depreſſed, or become round-ſhouldered and flat-breaſted (*a*) by the Preſſure and Weight of the impregnated *Uterus*, and by the ſtrong Action of the abdominal Muſcles.

The *Os ſacrum* is broader and turned much more backwards, for enlarging the *Pelvis*.

The

(*a*) *Cheſelden*, Anatomy, book 1. chap. 3.

The *Os Coccygis* is more moveable, and much leſs bended forwards, to facilitate the Birth.

The *Oſſa Iliûm* are more hollow, and more reflected outwards, and conſequently further removed from each other, in order to widen the lower Part of their *Abdomen*, and for the better Support of the impregnated *Uterus*.

The Ridge on the upper Part of the *Os Pubis* is larger in ſuch Women as have born Children, being extended by the ſtrong Action of the *Muſculi recti abdominis*.

The Cartilage between the two *Oſſa Pubis*, eſpecially in Women who have born Children, is thicker than in Men, by which the *Pelvis* is more capacious in Females.

The conjoined Surfaces of the *Oſſa Pubis*, and of the *Oſſa innominata* and *ſacrum* are leſs, that with the ſtreight *Os ſacrum* a larger Paſſage might be left for the Excluſion of the Child in Birth.

The great Tuberoſity of the *Oſſa Iſchiûm* is flatter in Women than in Men, becauſe it is more preſſed upon in the ſedentary Life which Females enjoy.

In Conſequence of the *Pelvis* of Women being wider, the Articulations of their Thigh-bones muſt be farther removed from each other; and therefore a larger Space is left for the Procreation and Birth of Children *(a)*; which Diſtance of the Thighs, may be one Reaſon why Women in running generally ſhuffle more from

---

(a) Albin. De Offib. § 339.

from one Side to the other than Men, to preſerve the Center of Gravity of their Bodies from falling too far to a Side of the Joint of the Thigh that ſupports them when the other is raiſed, which would endanger their tumbling to the Ground.

FINIS.

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